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THE COMMONWEALTH OF MASSACHUSETTS
William Francis Galvin, Secretary of the Commonwealth
State Publications and Regulations

REGULATION FILING AND PUBLICATION

1. Regulation Chapter, Number & Heading: **780 CMR**

2. Name of Agency: **THE MASSACHUSETTS STATE BUILDING CODE STATE BOARD OF BUILDING REGULATIONS & STANDARDS**

3 This document is reprinted from the Code of Massachusetts Regulations and contains the following:

This is the
Seventhth Edition of the Massachusetts State Building Code
as adopted by the
State Board of Building Regulations and Standards and filed with the
Office of the Secretary of the Commonwealth
(BASIC/COMMERCIAL)

Under the Provisions of Massachusetts General Laws, Chapter 30A, § 6, and Chapter 233, § 75, this document may be used as evidence of the original documents on file with the Secretary of the Commonwealth.

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BUILDING CODE 7TH COMMERC
BC7 COMMERCIAL
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William Francis Galvin

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Secretary of the Commonwealth

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3. This document is reprinted from the Code of Massachusetts Regulations and contains the following:

780 CMR 1	ADMINISTRATION
780 CMR 2	DEFINITIONS
780 CMR 3	USE & OCCUPANY CLASSIFICATION
780 CMR 4	SPECIAL DETAILED REQUIREMENTS BASED ON USE & OCCUPANCY
780 CMR 5	GENERAL BUILDING HEIGHTS & AREAS
780 CMR 6	TYPES OF CONSTRUCTION
780 CMR 7	FIRE-RESISTANCE-RATED CONSTRUCTION
780 CMR 8	INTERIOR FINISHES
780 CMR 9	FIRE PROTECTION & LIFE SAFETY SYSTEMS
780 CMR 10	MEANS OF EGRESS
780 CMR 11	ACCESSIBILITY
780 CMR 12	INTERIOR ENVIRONMENT
780 CMR 13	ENERGY CONSERVATION
780 CMR 14	EXTERIOR WALLS
780 CMR 15	ROOF ASSEMBLIES & ROOF TOP STRUCTURES

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780 CMR 16	**STRUCTURAL DESIGN**
780 CMR 17	**QUALITY ASSURANCE DURING CONSTRUCTION**
780 CMR 18	**FOUNDATIONS AND RETAINING WALLS**
780 CMR 19	**CONCRETE**
780 CMR 20	**ALUMINUM**
780 CMR 21	**MASONRY**
780 CMR 22	**STEEL**
780 CMR 23	**WOOD**
780 CMR 24	**GLASS AND GLAZING**
780 CMR 25	**GYPSUM BOARD AND PLASTER**
780 CMR 26	**PLASTIC**
780 CMR 27	**ELECTRICAL**
780 CMR 28	**MECHANICAL SYSTEMS**
780 CMR 29	**PLUMBING SYSTEMS**

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3. This document is reprinted from the Code of Massachusetts Regulations and contains the following:

780 CMR 30 ELEVATORS AND CONVEYING SYSTEMS
780 CMR 31 SPECIAL CONSTRUCTION
780 CMR 32 ENCROACHMENTS INTO THE PUBLIC RIGHT - OF - WAY
780 CMR 33 SAFEGUARDS DURING CONSTRUCTION
780 CMR 34 EXISTING STRUCTURES
780 CMR 35 REFERENCED STANDARDS
780 CMR 36-50 RESERVED
780 CMR 110 SPECIAL REGULATIONS
780 CMR 111-119 RESERVED
780 CMR 120 APPENDICES

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WILLIAM FRANCIS GALVIN
Secretary of the Commonwealth

THE MASSACHUSETTS STATE BUILDING CODE

780 CMR

Seventh Edition

COMMONWEALTH OF MASSACHUSETTS

Published by
William F. Galvin
Secretary of the Commonwealth

FOREWORD

THE MASSACHUSETTS STATE BUILDING CODE (780 CMR), SEVENTH EDITION

FOREWORD

The Seventh Edition of the Massachusetts State Building Code consists of two volumes; one volume addressing all building USES except One- and Two-family detached dwellings and a second volume addressing only One- and Two-family dwellings.

The Seventh Edition Massachusetts Building Code Volume (Basic Building Code) addressing all building USES except One- and Two-family detached buildings is based on the ICC International Building Code-2003 (IBC-2003) with significant Massachusetts modifications.

The Seventh Edition Massachusetts Building Code Volume addressing only One- and two-Family detached buildings is based on the ICC International Residential Code (IRC-2003) with significant Massachusetts modifications.

The Chapters of the two-volume Building Code set are numbered consecutively from 1 to 120, with Chapters 1-50 being dedicated to that Volume of the Building Code addressing all building USES except One- and Two- family detached buildings and Chapters 51-99 dedicated to that Code Volume addressing only One- and Two-Family detached dwellings.

Regulations 110.R1 through 110.R-6 (Chapter 110) and Appendices 120.A through 120.Z (Chapter 120) are shared with both Volumes of the Seventh Edition Massachusetts State Building Code.

Chapter 35 is the Referenced Standards Chapter for the 7th Edition Basic Building Code and Chapter 100 is the Referenced Standards Chapter for the 7th Edition One- and Two-Family Dwelling Code; Regulations 110.R-1 through 110.R7 address, with modification, the same subjects as the Sixth Edition State Building Code address in its Regulations Section (R-1 through R-6). Appendices 120.A through 120.Z address, with modification, most subjects addressed in the Sixth Edition State Building Code (most of the Sixth Edition Appendices A-K, redefined alphabetically) but with additional Appendices acquired as a result of utilizing the ICC IBC and IRC as the bases for the Seventh Edition Massachusetts Building Code.

Where Massachusetts requirements are different than requirements of the baseline IBC-2003 and IRC-2003, every effort has been made to identify such differences using ***bold and italicized print*** or in the case of entire chapters unique to Massachusetts by simply identifying such at the beginning of the chapter but because Massachusetts does not just adopt unaltered versions of the IBC and the IRC the Reader is cautioned to always utilize the Massachusetts State Building Code when designing and constructing/reconstructing buildings and structures in Massachusetts.

The Seventh Edition Massachusetts State Building Code, being a two volume Code, is being implemented in stages, with the Building Code for One- and Two-family Dwellings, being implemented first.

In recognition of the time periods involved in the planning, design and construction of buildings and building related projects, and in order to effect an orderly and equitable transition between the Sixth and the Seventh Edition , the State Board of Building Regulations and Standards has implemented a policy regarding continued use of the current Sixth Edition Building Code while the new Seventh Edition Basic Building Code is also implemented (Please refer to the Department of Public Safety/Board of Building Regulations and Standards web page for such guidance - www.mass.gov/DPS).

The 7th Edition Building Code for One- and Two-Family Dwellings ran concurrent with the earlier 6th Edition Code during calendar year 2007 and became the singular one- and two-family Building Code as of January 1, 2008.

PURCHASING

The Secretary of the Commonwealth is the "legal keeper of the record" for all Codes of Massachusetts Regulation (CMRs) and court-certifiable versions of CMRs can only be obtained through the Secretary of the Commonwealth. As such, the Massachusetts Building Code may be purchased by visiting the State House Bookstore located in the State House building in Boston, Massachusetts or by calling the Bookstore at 617-727-2834 (to order on line, also see www.mass.gov and select the Secretary of the Commonwealth web page and select "Statehouse Bookstore/Publications and Regulations) .

AMENDMENT PROCESS

Pursuant to M.G.L. c. 143, § 97, 780 CMR is subject to change by amendment. Amendments shall be proposed on Forms made available at the Department of Public Safety and also found in Appendix 120.P of the Seventh Edition Building Code. Proposals are presented at public hearing where the Board of Building Regulations and Standards (BBRS) hears testimony both for and against such proposals. Ultimately, when the BBRS adopts a proposal such adopted amendments to 780 CMR become effective when promulgated and first appear published in the Bi-weekly ***MASSACHUSETTS REGISTER***, issued by the Secretary of the Commonwealth (Publications and Regulations Division).

All proposals for amendment to 780 CMR must be received at least 60 days prior to the public hearing date. Changes that are voted approved are issued on a cycle determined by the BBRS.

The BBRS is mandated by law to convene public hearings to entertain changes to the Code a minimum of twice each calendar year; in May and November. Other public hearings may be scheduled as necessary.

Anyone wishing to present a code change should contact the Department of Public Safety/Board of Building Regulations and Standards at:

One Ashburton Place, Room1301
Boston, MA 02108.

It is the responsibility of the Code-user to check the *MASSACHUSETTS REGISTER* to determine if amendments have been issued against 780 CMR or any other Construction Code (Electrical, Plumbing and Gas, Fire, Architectural Access, Elevator, etc.) of the Commonwealth.

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NON-TEXT PAGE

TABLE OF CONTENTS

780 CMR 1.00 ADMINISTRATION

Section

101 Scope 11
102 Applicability 12
103 Maintenance 13
104 Validity 13
105 Office of the Inspector of Buildings or Building Commissioner 13
106 Duties and Powers of the Building Official 14
107 Duties and Powers of the State Inspector 16
108 Rules and Regulations 17
109 Approval 18
110 Application for Permit 19
111 Permits 22
112 Demolition of Structures 23
113 Conditions of Permit 24
114 Fees 24
115 Inspection 24
116 Registered Architectural and Professional Engineering Services – Construction Control 25
117 Workmanship 26
118 Violations 26
119 Stop Work Order 27
120 Certificate of Occupancy 27
121 Unsafe Structures 28
122 Board of Appeals 30
123 Construction Materials Safety Board 33
124 Fire Prevention – Fire Protection Advisory Committee 33
125 Structural Peer Review Advisory Committee 34

780 CMR 2.00 DEFINITIONS

Section

201 General 35
202 Definitions 35

780 CMR 3.00 USE AND OCCUPANCY CLASSIFICATION

Section

301 General 45
302 Classification 45
303 Assembly Group A 49
304 Business Group B 49
305 Educational Group E 50
306 Factory Group F 50
307 High-Hazard Group H 50
308 Institutional Group I 59
309 Mercantile Group M 61
310 Residential Group R 61
311 Storage Group S 62
312 Utility and Miscellaneous Group U 63

780 CMR 4.00 SPECIAL DETAILED REQUIREMENTS BASED ON USE AND OCCUPANCY

Section

401 Scope 65
402 Covered Mall Buildings 65
403 High-Rise Buildings 69
404 Atriums 70
405 Underground Buildings 71
406 Motor-vehicle-related Occupancies 72
407 Group I-2 76
408 Group I-3 77
409 Motion Picture Projection Rooms 80
410 Stages and Platforms 80
411 Special Amusement Buildings 83
412 Aircraft-related Occupancies 83
413 Combustible Storage 85
414 Hazardous Materials 86
415 Groups H-1, H-2, H-3, H-4 and H-5 90
416 Application of Flammable Finishes 102
417 Drying Rooms 103
418 Organic Coatings 103
419 Mobile Units 103
420 Swimming Pools 103
421 Group Residence 103
422 Day Care Centers 105
423 Summer Camps for Children 110
424 Bulk Merchandising Retail Buildings 110
425 Limited Group Residence 115
426 Detoxification Facilities 118
427 Group Dwelling Units 120

780 CMR 5.00 GENERAL BUILDING HEIGHTS AND AREAS

Section

501 General 125
502 Definitions 125
503 General Height and Area Limitations 125
504 Height Modifications 127
505 Mezzanines 127
506 Area Modifications 128
507 Unlimited Area Buildings 129
508 Special Provisions 130

780 CMR 6.00 TYPES OF CONSTRUCTION

Section

601 General 133
602 Construction Classification 133
603 Combustible Material in Type I and II Construction 134

780 CMR 7.00 FIRE-RESISTANCE-RATED CONSTRUCTION

Section

701 General 137
702 Definitions 137
703 Fire-Resistance Ratings and Fire Tests 138
704 Exterior Walls 140
705 Fire Walls 143
706 Fire Barriers 145
707 Shaft Enclosures 146
708 Fire Partitions 149
709 Smoke Barriers 149
710 Smoke Partitions 150
711 Horizontal Assemblies 150
712 Penetrations 151
713 Fire-resistant Joint Systems 153
714 Fire-resistance Rating of Structural Members 154
715 Opening Protectives 155
716 Ducts and Air Transfer Openings 159
717 Concealed Spaces 162

TABLE OF CONTENTS - continued

718 Fire-resistance Requirements for Plaster 164
719 Thermal- and Sound-Insulating Materials 164
720 Prescriptive Fire Resistance 165
721 Calculated Fire Resistance 183

780 CMR 8.00 INTERIOR FINISHES

Section

801 General 213
802 Definitions 213
803 Wall and Ceiling Finishes 213
804 Interior Floor Finish 216
805 Decorations and Trim 217

780 CMR 9.00 FIRE PROTECTION AND LIFE SAFETY SYSTEMS

Section

901 General 219
902 Definitions 222
903 Automatic Sprinkler Systems 226
904 Alternative Automatic Fire-extinguishing Systems 231
905 Standpipe Systems 232
906 Portable Fire Extinguishers 235
907 Fire Alarm and Detection Systems 235
908 Emergency Alarm Systems 244
909 Smoke Control Systems 245
910 Smoke and Heat Vents 254
911 Fire Command Center 256
912 Fire Department Connections 256
913 Private Underground Fire Mains and Yard Hydrants 256
914 Fire Pumps 256
915 Carbon Monoxide Protection 257

780 CMR 10.00 MEANS OF EGRESS

Section

1001 Administration 259
1002 Definitions 259
1003 General Means of Egress 261
1004 Occupant Load 262
1005 Egress Width 263
1006 Means of Egress Illumination 263
1007 Accessible Means of Egress 264
1008 Doors, Gates and Turnstiles 266
1009 Stairways and Handrails 271
1010 Ramps 274
1011 Exit Signs 276
1012 Guards 276
1013 Exit Access 277
1014 Exit and Exit Access Doorways 279
1015 Exit Access Travel Distance 280
1016 Corridors 281
1017 Exits 282
1018 Number of Exits and Continuity 282
1019 Vertical Exit Enclosures 283
1020 Exit Passageways 285
1021 Horizontal Exits 285
1022 Exterior Exit Ramps and Stairways 286
1023 Exit Discharge 287
1024 Assembly 288
1025 Emergency Escape and Rescue 293

780 CMR 11.00 ACCESSIBILITY

Section

1101 Jurisdiction 295

780 CMR 12.00 INTERIOR ENVIRONMENT

Section

1201 General 297
1202 Definitions 297
1203 Ventilation 297
1204 Temperature Control 299
1205 Lighting 299
1206 Yards or Courts 299
1207 Sound Transmission 300
1208 Interior Space Dimensions 300
1209 Access to Unoccupied Spaces 300
1210 Surrounding Materials 301

780 CMR 13.00 ENERGY CONSERVATION

Section

1301 Administration 303
1302 Definitions 307
1303 Design Conditions 313
1304 Building Envelope Requirements 314
1305 Heating, Ventilation and Air Conditioning 324
1306 Service Water Heating 340
1307 Electric Power Distribution 340
1308 Lighting Systems 343
1309 Building Design by Systems Analysis 350

780 CMR 14.00 EXTERIOR WALLS

Section

1401 General 353
1402 Definitions 353
1403 Performance Requirements 353
1404 Materials 354
1405 Installation of Wall Coverings 355
1406 Combustible Materials on the Exterior Side of Exterior Walls 359
1407 Metal Composite Materials (MCM) 360

780 CMR 15.00 ROOF ASSEMBLIES AND ROOF TOP STRUCTURES

Section

1501 General 363
1502 Definitions 363
1503 Weather Protection 363
1504 Performance Requirements 364
1505 Fire Classification 364
1506 Materials 365
1507 Requirements for Roof Coverings 365
1508 Roof Insulation 375
1509 Rooftop Structures 375
1510 Reroofing 376

780 CMR 16.00 STRUCTURAL DESIGN

Section

1601 General 379
1602 Definitions and Notations 379

TABLE OF CONTENTS - continued

1603 Construction Documents . . . 380
1604 General Design Requirements . . . 381
1605 Load Combinations . . . 390
1606 Dead Loads . . . 391
1607 Live Loads . . . 391
1608 Snow Loads . . . 396
1609 Wind Loads . . . 398
1610 Lateral Soil and Hydrostatic Loads . . . 400
1611 Rain Loads . . . 400
1612 Flood Loads . . . 400
1613 Earthquake Loads - Purpose . . . 400
1614 Earthquake Loads - General . . . 401
1615 Earthquake Loads - Modifications to Applicable Provisions of ASCE 7 . . . 401
1616 through 1623 Reserved . . . 416
1624 *In-situ* Load Tests . . . 416
1625 Alternative Test Procedure . . . 416
1626 Test Safe Load . . . 417
1627 Preconstruction Load Tests . . . 417

780 CMR 17.00 QUALITY ASSURANCE DURING CONSTRUCTION

Section

1701 General . . . 419
1702 Definitions . . . 420
1703 Quality Assurance for Structural Components and Assemblies . . . 420
1704 Quality Assurance for Curtain Wall Construction . . . 426
1705 Quality Assurance for Sprayed Fire Resistive Materials . . . 426
1706 Quality Assurance for Smoke Control Systems . 426
1707 Quality Assurance for Stairs and Railings . . . 427
1708 Quality Assurance for Non-structural Assemblies . . . 427

780 CMR 18.00 FOUNDATIONS AND RETAINING WALLS

Section

1801 General . . . 429
1802 Foundation and Soils Investigations . . . 429
1803 Excavation, Grading and Fill . . . 430
1804 Allowable Load-bearing Values . . . 431
1805 Footings and Mat Foundations . . . 436
1806 Foundation Walls and Retaining Walls . . . 438
1807 Dampproofing, Waterproofing and Groundwater Control . . . 442
1808 Pier and Pile Foundations . . . 444
1809 Driven Pile Foundations . . . 452
1810 Cast-in-Place Concrete Pile Foundations . . . 455
1811 Composite Piles . . . 462
1812 Pier Foundations . . . 462

780 CMR 19.00 CONCRETE

Section

1901 General . . . 465
1902 through 1907 Reserved . . . 465
1908 Modifications to ACI 318 . . . 465
1909 Reserved . . . 467
1910 Seismic Design Provisions . . . 467
1911 Minimum Slab Provisions . . . 468
1912 Reserved . . . 468
1913 Anchorage to Concrete . . . 468
1914 Shotcrete . . . 468
1915 Reinforced Gypsum Concrete . . . 470
1916 Concrete-Filled Pipe Columns . . . 470

780 CMR 20.00 ALUMINUM

Section

2001 General . . . 471
2002 Materials . . . 471

780 CMR 21.00 MASONRY

Section

2101 General . . . 473
2102 Definitions and Notations . . . 473
2103 Modifications to ACI 530 . . . 475
2104 Masonry Construction Materials . . . 475
2105 Construction . . . 476
2106 Seismic Design for Shear Walls . . . 476
2107 Walls Isolated from the Lateral Load Resisting System . . . 478
2108 Additional Requirements . . . 479
2109 and 2110 Reserved . . . 479
2111 Masonry Fireplaces . . . 479
2112 Masonry Heaters . . . 484
2113 Masonry Chimneys . . . 485

780 CMR 22.00 STEEL

Section

2201 General . . . 491
2202 Definitions and Nomenclature . . . 491
2203 Identification . . . 492
2204 Reserved . . . 492
2205 Structural Steel . . . 492
2206 Steel Joists . . . 494
2207 Steel Cable Structures . . . 494
2208 Steel Storage Racks . . . 494
2209 Cold-formed Steel . . . 494
2210 Cold-formed Steel Light Framed Construction . 495
2211 Cold-formed Steel Light-Framed Shear Walls . 495
2212 Cast-steel Construction . . . 500

780 CMR 23.00 WOOD

Section

2301 General . . . 500.1
2302 Definitions . . . 500.1
2303 Supplemental Requirements . . . 500.2
2304 General Construction Requirements . . . 500.6
2305 General Design Requirements for Lateral-Force-Resisting Systems . . . 500.13
2306 Capacity and Construction of Lateral Force Resisting Systems . . . 500.21

780 CMR 24.00 GLASS AND GLAZING

Section

2401 General . . . 500.33
2402 Definitions . . . 500.33
2403 General Requirements for Glass . . . 500.33

TABLE OF CONTENTS - continued

2404 Wind, Snow, Seismic and Dead Loads on Glass 500.33
2405 Sloped Glazing and Skylights 500.41
2406 Safety Glazing 500.43
2407 Glass in Handrails and Guards 500.45
2408 Glazing in Athletic Facilities 500.45
2409 Glass in Floors and Sidewalks 500.45

780 CMR 25.00 GYPSUM BOARD AND PLASTER

Section

2501 General 500.47
2502 Definitions 500.47
2503 Inspection 500.47
2504 Vertical and Horizontal Assemblies 500.47
2505 Shear Wall Construction 500.47
2506 Gypsum Board Materials 500.48
2507 Lathing and Plastering 500.48
2508 Gypsum Construction 500.48
2509 Gypsum Board in Showers and Water Closets 500.49
2510 Lathing and Furring for Cement Plaster (Stucco) 500.50
2511 Interior Plaster 500.50
2512 Exterior Plaster 500.51
2513 Exposed Aggregate Plaster 500.52

780 CMR 26.00 PLASTIC

Section

2601 General 500.53
2602 Definitions 500.53
2603 Foam Plastic Insulation 500.53
2604 Interior Finish and Trim 500.56
2605 Plastic Veneer 500.57
2606 Light-Transmitting Plastics 500.57
2607 Light-Transmitting Plastic Wall Panels 500.58
2608 Light-Transmitting Plastic Glazing 500.59
2609 Light-Transmitting Plastic Roof Panels 500 59
2610 Light-Transmitting Plastic Skylight Glazing 500.60
2611 Light-Transmitting Plastic Interior Signs 500.61

780 CMR 27.00 ELECTRICAL

Section

2701 General 500.63
2702 Emergency and Standby Power Systems 500.63

780 CMR 28.00 MECHANICAL SYSTEMS

Section

2801 General 500.65

780 CMR 29.00 PLUMBING SYSTEMS

Section

2901 General 500.67

780 CMR 30.00 ELEVATORS AND CONVEYING SYSTEMS

Section

3001 General 500.69
3002 Hoistway Enclosures 500.69
3003 Machine Rooms 500.69

780 CMR 31.00 SPECIAL CONSTRUCTION

Section

3101 General 500.71
3102 Membrane Structures 500.71
3103 Temporary Structures 500.73
3104 Pedestrian Walkways and Tunnels 500.73
3105 Awnings and Canopies 500.74
3106 Marquees 500.75
3107 Signs 500.75
3108 Radio and Television Towers 500.75
3109 Swimming Pool Enclosures and Safety Devices 500.75

780 CMR 32.00 ENCROACHMENTS INTO THE PUBLIC RIGHT-OF-WAY

Section

3201 General 500.77
3202 Encroachments 500.77

780 CMR 33.00 SAFEGUARDS DURING CONSTRUCTION

Section

3301 General 500.79
3302 Construction Safeguards 500.79
3303 Demolition 500.79
3304 Site Work 500.79
3305 Sanitary 500.80
3306 Protection of Pedestrians 500.80
3307 Protection of Adjoining Property 500.81
3308 Temporary Use of Streets, Alleys and Public Property 500.81
3309 Fire Extinguishers 500.81
3310 Exits 500.82
3311 Standpipes 500.82
3312 Automatic Sprinkler System 500.82
3313 Design Loads on Structures During Construction 500.82

780 CMR 34.00 EXISTING STRUCTURES

Section

3400 Scope 500.83
3401 Definitions 500.85
3402 Implementation 500.86
3403 Hazard Index 500.87
3404 Requirements for Continuation of the Same *Use Group* or Change to a *Use Group* Resulting in a Change in *Hazard Index* of One or less 500.87
3405 Requirement for Change in *Use Group* to Two or More *Hazard Indices* Greater 500.89
3406 *Compliance Alternatives* 500.89
3407 Energy Provisions for *Existing Buildings* 500.89
3408 Structural Requirements for *Existing Buildings* 500.91
3409 Historic Buildings 500.101

780 CMR 35.00 REFERENCED STANDARDS 500.105

780 CMR 36.00 THROUGH 50.00 RESERVED 500.123

TABLE OF CONTENTS - continued

780 CMR 51.00 THROUGH 109.00 501

See Seventh Edition of Massachusetts Building Code for One and Two Family Dwellings

780 CMR 110.00 SPECIAL REGULATIONS

Section

110.R1 Concrete Testing Laboratories Licensing 925
110.R2 Concrete Field Testing Technician 929
110.R3 Manufactured Buildings, Building Components and Mobile Homes 931
110.R4 Licensing Native Lumber Producers 945
110.R5 Construction Supervisors 947
110.R6 Registration and Enforcement of Home Improvement Contractor Program 955
110.R7 Certification of Inspectors of Buildings, Building Commissioners and Local Inspectors 967

780 CMR 111.00 THROUGH 119.00 RESERVED

780 CMR 120.00 APPENDICES

120.A Employee Qualifications 981
120.B Board of Appeals 983
120.C Group U Agricultural Buildings 985
120.D (*Reserved*) 987
120.E Supplementary Accessibility Requirements ... 989
120.F Rodent Proofing 991
120.G Flood Resistant Construction and Construction in Coastal Dunes 993
120.H Signs 1003
120.I Patio Covers 1009
120.J Grading 1011
120.K Manufactures Housing Used as Dwellings ... 1015
120.L Manufactured Buildings, Manufactured Building Components and Manufactured Housing 1021
120.M Swimming Pools, Spas and Hot Tubs 1025
120.N Private Sewage Disposal 1029
120.O Sound Transmission 1031
120.P Standard Forms and Applications 1033
120.Q Recommended Fastening Schedule 1059
120.R Guidance for Selection of Foundation Material Classes 1063
120.S Reference Data for Repair, Alteration, and Change of Use of Existing Buildings 1067
120.T (*Reserved*) 1089
120.U Independent Structural Engineer Review 1095
120.V Energy Provisions 1097
120.W Floor Protector Thermal Conductivity Calculations 1099
120.X Schedule of Fees 1101
120.Y Historic Structures 1105
120.Z Design and Construction of Townhouses 1109

The Index to the one- and two-family dwellings Code can be found on pages 1111 through 1120 which are included with 780 CMR 51.00 through 99.00. Those pages are not included with this basic/commercial Code 780 CMR 1.00 through 50.00.

INDEX to 780 CMR 1.00 through 50.00 1121

TABLE OF CONTENTS - continued

(PAGES 7 THROUGH 10 ARE RESERVED FOR FUTURE USE.)

780 CMR 1.00

ADMINISTRATION

780 CMR 1.00 is unique to Massachusetts

780 CMR 101.0 SCOPE

101.1 Title. 780 CMR 780 CMR shall be known as the Commonwealth of Massachusetts State Building Code.

101.2 Scope. In accordance with M.G.L. c. 143, §§ 92 through 100, the provisions of 780 CMR shall apply to:

(a) the construction, reconstruction, alteration, repair, demolition, removal, inspection, issuance and revocation of permits or licenses, installation of equipment, classification and definition of any building or structure and use or occupancy of all buildings and structures or parts thereof except bridges and appurtenant supporting structures which have been or are to be constructed by, or are under the custody and control of the Massachusetts Highway Department, the Massachusetts Turnpike Authority, the Massachusetts Bay Transportation Authority, the Department of Conservation and Recreation, or the Massachusetts Port Authority or for which said agencies have maintenance responsibility;

(b) the rehabilitation and maintenance of existing buildings;

(c) the standards or requirements for materials to be used in connection therewith, including but not limited to provisions for safety, ingress and egress, energy conservation and sanitary conditions;

(d) the establishment of reasonable fees for inspections and the issuance of licenses to individuals engaged as construction supervisors;

(e) the certification of inspectors of buildings, building commissioners and local inspectors and;

(f) the registration of Home Improvement Contractors pursuant to M.G.L. c. 142A, except as such matters are otherwise provided for in the Massachusetts General Laws Annotated, or in the rules and regulations authorized for promulgation under the provisions of 780 CMR.

(g) other duties and responsibilities as defined in Special Regulations 780 CMR 110.R1 through 110.R7.

> **Exception**. Detached one- and two-family dwellings designed as R-3 structures that are not more than three stories in height and that have separate means of egress (and their accessory structures) shall comply with 780 CMR 120.Z

101.3 Application of References. Unless otherwise specifically provided for in 780 CMR, all references to chapter or section numbers, or to provisions not specifically identified by number, shall be construed to refer to such chapter, section or provision of 780 CMR.

101.4 Intent. 780 CMR shall be construed to secure its expressed intent, which is to insure public safety, health and welfare insofar as they are affected by building construction, through structural strength, adequate means of egress facilities, sanitary conditions, light and ventilation, energy conservation and fire safety; and, in general, to secure safety to life and property from all hazards incident to the design, construction, reconstruction, alteration, repair, demolition, removal, use or occupancy of buildings, structures or premises.

101.5 Specialized Codes. In accordance with M.G.L. c. 143, § 96, specialized codes, rules or regulations pertaining to building construction, reconstruction, alteration, repair or demolition, and inspection promulgated by, and under the authority of the various boards which have been authorized by the general court shall be incorporated into 780 CMR. Areas regulated by the specialized codes shall require that all such work performed is designed, installed and inspected in accordance with the specialized codes.

For governing regulations addressing the approval, design, installation and maintenance of fossil fuel-burning appliances, refer to the Massachusetts Fuel Gas and Plumbing Code (248 CMR) for gas and the Massachusetts Fire Prevention Regulations State Fire Code (527 CMR) for oil. Applicable specialized codes, rules or regulations relating to building systems include, but are not limited to, those identified in 780 CMR 101.5.1 through 101.5.9 and those listed in 780 CMR 35.00.

101.5.1 Architectural Access. The Architectural Access Code (521 CMR).

101.5.2 Department of Environmental Protection; Environmental Protection (310 CMR); Water Pollution Control (314 CMR)

101.5.3 Electrical. Massachusetts State Electrical Code (527 CMR 12.00).

101.5.4 Elevator. Massachusetts Elevator Code (524 CMR).

101.5.5 Fire Prevention. The Massachusetts Fire prevention Code (527 CMR).

101.5.6 Gas. Massachusetts Fuel Gas and Plumbing Code (248 CMR).

101.5.7 Mechanical. The International Mechanical Code (Not a specialized code but a subset of the Massachusetts State Building Code).

101.5.8 Plumbing. Massachusetts Fuel Gas and Plumbing Code (248 CMR).

101.5.9 Property Maintenance. 780 CMR and, where applicable, the State Sanitary Code (105 CMR).

101.6 Referenced Standards. The standards referenced in 780 CMR and listed in 780 CMR 35.00 shall be considered part of the requirements of 780 CMR to the prescribed extent of each such reference. Where differences occur between provisions/allowances of 780 CMR and referenced standards, the provisions of 780 CMR shall apply. The administrative provisions of 780 CMR shall apply to all standards referenced in 780 CMR 35.00, other than those of the specialized codes in listed in 780 CMR 101.5.

Exception. Where enforcement of a provision of 780 CMR would violate the conditions of a listing of the equipment or appliance, the conditions of the listing and manufacturer's instructions shall apply.

780 CMR 102.0 APPLICABILITY

102.1 General. The provisions of 780 CMR shall apply to all matters affecting or relating to buildings and structures, as set forth in 780 CMR 101.0 and shall apply with equal force to municipal, county, state authorities of, or established by the legislature and private buildings and structures, except where such buildings and structures are otherwise provided for by statute. The construction, reconstruction, alteration, repair, addition, change in use or occupancy, demolition, removal of all buildings and structures shall comply with 780 CMR.

102.2 Matters not Provided for. Any requirements that are essential for the structural, fire or sanitary safety, energy conservation, interior climate comfort of an existing or proposed building or structure, or for the safety of the occupants thereof, which are not specifically provided for by 780 CMR, shall be determined by the building official. The State Board of Building Regulations and Standards (BBRS) and the Department of Public Safety shall be notified by the building official in writing within seven working days of any action taken pursuant to 780 CMR 102.2.

Note 1 - Buildings and portions of buildings and specialty building permittable systems dedicated to: specialized industrial processes, water treatment, waste water treatment, other specialized chemical and factory processes, etc.; certain aspects of public transportation buildings and other highly specialized buildings or portions thereof may require that aspects of their design and construction conform to certain Specialized Code requirements and/or nationally-recognized design and construction standards not explicitly identified in 780 CMR and the architects/ engineers of record are responsible for providing to the Building Official, sufficient information, calculations and technical defense as to why such buildings or portions thereof and building permittable systems should be addressed under 780 CMR 102.0 and not otherwise be required to comply with the code generally and as applicable.

Refer to 780 CMR 101.5 and conformance to all applicable Specialized Code requirements is required.

Note 2 – The substitution of "alternative fire protection design methodologies" requires conformance to the requirements of 780 CMR 903.2.1.

102.3 Zoning Bylaw Restrictions. When the provisions herein specified for structural strength, adequate egress facilities, sanitary conditions, equipment, light and ventilation, energy conservation or fire safety conflict with the local zoning bylaws or ordinances, 780 CMR shall control the construction or alteration of buildings and structures unless such bylaws or ordinances are promulgated in accordance with the provisions of M.G.L. c. 143, § 98.

102.4 General Bylaw Restrictions. When the provisions herein specified for structural strength, adequate egress facilities, sanitary conditions, equipment, light and ventilation, energy conservation or fire safety conflict with the local general bylaws or ordinances, 780 CMR shall control the construction or alteration of buildings and structures unless such bylaws or ordinances are promulgated in accordance with the provisions M.G.L. c. 143, § 98.

102.5 Existing Buildings. Existing buildings and structures shall comply with the provisions of 780 CMR 102.0, and 780 CMR 34.00 and all other applicable provisions of 780 CMR.

102.5.1 General. Unless specifically provided otherwise in 780 CMR, any existing building or structure shall meet and shall be presumed to meet the provisions of the applicable laws, codes, rules or regulations, bylaws or ordinances in effect at the time such building or structure was constructed or altered and shall be allowed to continue to be occupied pursuant to its use and occupancy, provided that the building or structure shall be maintained in accordance with 780 CMR 103.0.

102.5.2. In cases which applicable codes, rules or regulations, bylaws or ordinances were not in use at the time of such construction or alteration, the provisions of 780 CMR 103.0 shall apply.

102.5.3. In cases where the provisions of 780 CMR are less stringent than the applicable codes, rules or regulations, bylaws or ordinances at the time of such construction or substantial alteration, the applicable provisions of 780 CMR shall apply, providing such application of these provisions can be reasonably demonstrated to notresult in danger to the public, as determined by the building official.

102.5.4 Existing Non Conforming Means of Egress. The following conditions, when observed by the Building Official, shall be cited in writing as a violation. Said citation shall order the abatement of the non compliance and shall include such time element as the building official deems necessary for the protection of the occupants thereof, or as otherwise provided for by the statute.

1. Less than the number of means of egress serving every space and/or story required by 780 CMR 1010.0 and Table 1010.2
2. Any required means of egress component which is not of sufficient width.to comply with 780 CMR 1009.0 and 780 CMR 34.00, or is not so arranged as to provide safe and adequate means of egress, including exit signage and emergency lighting.

102.5.5 Hazardous Means of Egress/Exit Order. In any building or structure not provided with exit facilities as herein prescribed for new buildings and, in which the exits are deemed hazardous or dangerous to life and limb, the building official shall declare such building dangerous and unsafe in accordance with the provisions of 780 CMR 121.0

102.5.5.1 Appeal from Exit Order. Any person served with any order pursuant to 780 CMR 102.5.5 shall have the remedy prescribed in 780 CMR 121.0.

102.5.6 Unsafe Lighting and/or Unsafe Ventilation. In any existing building, or portion thereof,

(a) in which the light or ventilation do not meet the applicable provisions of 780 CMR 12.0 and

(b) which is deemed by the building official to be dangerous or hazardous to the health and safety of the occupants

the building official shall order the abatement of such conditions to render the building or structure occupiable or habitable as applicable for the posted use and occupant load.

In enforcing 780 CMR 102.5.6, the building official may require or accept engineering or other evaluations of the lighting and/or ventilation systems in order to evaluate possible dangerous or hazardous conditions and accept solutions.

Where full compliance with 780 CMR for light and ventilation as required for new construction is not practical for structural and/or other technical reasons, the building official may accept compliance alternatives, or engineering or other evaluations which adequately address the building or structure livability for the posted use and occupant load.

102.5.7 Moved Structures. Buildings or structures moved into or within the jurisdiction shall comply with the provisions of 780 CMR 34.00 provided that any new system shall comply as far as practicable with the requirements for new structures and provided further that the siting and fire separation distance comply with the requirements for new structures.

780 CMR 103.0 MAINTENANCE

103.1 General. All buildings and structures and all parts thereof, both existing and new, and all systems and equipment therein which are regulated by 780 CMR shall be maintained in a safe, operable and sanitary condition. All service equipment, means of egress, devices and safeguards which are required by 780 CMR in a building or structure, or which were required by a previous statute in a building or structure, when erected, altered or repaired, shall be maintained in good working order.

103.2 Owner Responsibility. The owner, as defined in 780 CMR 2.00, shall be responsible for compliance with provisions of 780 CMR 103.0.

780 CMR 104.0 VALIDITY

104.1 General. The provisions of 780 CMR are severable, and if any of its provisions shall be held unconstitutional or otherwise invalid by any court of competent jurisdiction, the decision of such court shall not affect or impair any of the remaining provisions.

780 CMR 105.0 OFFICE OF THE INSPECTOR OF BUILDINGS OR BUILDING COMMISSIONER

105.1 Appointment. The chief administrative officer of each city or town shall employ and designate an inspector of buildings or building commissioner (inspector of buildings) as well as such other local inspectors as are reasonably necessary to assist the inspector of buildings to administer and enforce 780 CMR, M.G.L. c. 22, § 13A and 521 CMR. The inspector of buildings shall report directly to and be solely responsible to the appointing authority.

105.2 Alternate. The inspector of buildings is authorized to designate an alternate who shall exercise all the powers of the inspector of buildings during the temporary absence, disability or conflict of interest of the inspector of buildings. Said alternate shall be duly qualified and certified pursuant to 780 CMR 105.3.

105.3 Qualifications of the Inspector of Buildings. In accordance with the provisions of M.G.L. c. 143, § 3, each inspector of buildings shall have had at least five years of experience in the supervision of building construction or design or in the alternative a four year undergraduate degree in a field related to building construction or design, or any combination of education and experience which would confer equivalent knowledge and ability, as determined by the BBRS. In addition each inspector of buildings shall have had general knowledge of the accepted requirements for building construction, fire prevention, light, ventilation and safe egress; as well as a general knowledge of other equipment and materials essential for safety, comfort and convenience of the occupants of a building or structure.

Each inspector of buildings shall be certified by the BBRS in accordance with the provisions of Special Regulation 780 CMR 110.R7: *Certification of Inspectors of Buildings, Building Commissioners and Local Inspectors*.

Municipalities may require additional qualifications or experience as are deemed necessary.

105.4 Qualifications of the Local Inspector. In accordance with the provisions of M.G.L. c. 143, § 3, each local inspector shall have had at least five years of experience in the supervision of building construction or design or in the alternative a two year associates degree in a field related to building construction or design, or any combination of education and experience which would confer equivalent knowledge and ability, as determined by the BBRS. In addition, such persons shall have had general knowledge of the accepted requirements for building construction, fire prevention, light, ventilation and safe egress; as well as a general knowledge of other equipment and materials essential for safety, comfort and convenience of the occupants of a building or structure.

Each local inspector shall be certified by the BBRS in accordance with the provisions of Special Regulation 780 CMR 110.R7: *Certification of Inspectors of Buildings, Building Commissioners and Local Inspectors*.

Municipalities may require additional qualifications or experience as are deemed necessary.

105.5 Reporting Requirements.

105.5.1 Annual Report by City or Town Clerk. In accordance with the provisions of M.G.L. c. 143, § 3, the clerk of each city or town shall, annually, not later than April first, transmit to the BBRS the names and official address of each inspector of buildings, building commissioner and local inspector as well as at such other times as required pursuant to Special Regulation 780 CMR 110.R7: *Certification of Inspectors of Buildings, Building Commissioners and Local Inspectors*. Such reports shall be submitted on forms prescribed by the BBRS for said purpose.

105.5.2. New Appointments. Immediately following appointment, the clerk of each city or town shall report to the BBRS, the name, title and status of each new employee who is appointed as an inspector of buildings, building commissioner or local inspector. Said report shall be provided on forms as prescribed by the BBRS for said purpose and shall be submitted in attestation under the pains and penalties of perjury that said new employee meets or exceeds the minimum qualifications as defined by M.G.L. c. 143, § 3 and 780 CMR 105.3 and 105.4 as applicable.

105.6 Restriction of Employees. Unless authorized by the municipal appointing authority no full-time or part-time building commissioner, inspector of buildings, or full-time or part-time local inspector as defined herein shall be engaged in, or directly or indirectly connected with, the furnishing of labor, materials or appliances for the construction, alteration or maintenance of a building or structure, or the preparation of plans or of specifications therefore within the city, town or region for which he or she is appointed, unless he or she is the owner of the building or structure; nor shall any officer or employee associated with the building department engage in any work which conflicts with his or her official duties or with the interests of the department.

Note. *See* M.G.L. c. 143, § 3Z: *Part Time Inspector of Buildings, Building Commissioner, Local Inspector, or Alternate Inspector; Other Employment* (Local Option law relative to part-time employees).

105.7 Relief from Personal Liability. Insofar as the law allows, while acting for the municipality, the building official charged with the enforcement of 780 CMR shall not be deemed personally liable in the discharge of his official duties.

105.8 Official Records. An official record shall be kept of all business and activities of the department specified in the provisions of 780 CMR. In accordance with the provisions of M.G.L. c. 66, § 10(b), all such records shall be open to public inspection at all appropriate times and according to reasonable rules to maintain the integrity and security of such records.

780 CMR 106.0 DUTIES AND POWERS OF THE BUILDING OFFICIAL

106.1 General. The inspector of buildings and local inspector (building official) shall enforce all of the provisions of 780 CMR, 521 CMR (Architectural Access Board) and any other state statutes, rules and regulations, or ordinances or bylaws which empower the building official. The building official shall act on any question relative to the mode or manner of construction and materials to be used in the construction, reconstruction, alteration, repair, demolition, removal, installation of equipment and the location, use, occupancy and maintenance of all buildings and structures, except as otherwise specifically provided for by statutory requirements or as provided for in 780 CMR 109.0.

106.2 Applications and Permits. The building official shall receive applications and issue permits for the construction, reconstruction, alteration, repair, demolition, removal or change in use or occupancy of buildings and structures; inspect the premises for which such permits have been issued and enforce compliance with the provisions of 780 CMR.

106.3 Notices and Orders. The building official shall issue all necessary notices or orders to ensure compliance with 780 CMR.

106.4 Inspections. The building official shall make such inspections as deemed necessary to ensure compliance with 780 CMR, or the building official may accept reports of inspection by qualified agencies or individuals, which reports shall be in writing and be certified by a responsible officer of such agency or by the responsible individual. The building official is authorized to engage such expert opinion as deemed necessary to report upon unusual technical issues that arise, subject to the approval of the appointing authority.

106.5 Inspection and Certification of Specified Use Groups. The building official shall periodically inspect and certify buildings and structures or parts thereof in accordance with Table 106. A building or structure shall not be occupied or continue to be occupied without the posting of a valid certificate of inspection where required by Table 106. A certificate of inspection as specified in 780CMR 106.5 shall not be issued until an inspection is made certifying that the building or structure or parts thereof complies with all the applicable requirements of 780 CMR, and until the inspection fee, if a fee is required by the municipality, is paid.

Exception. Municipalities may revise or modify, or waive in part those fees for buildings and structures or parts thereof owned by the municipality, county or political subdivision thereof and for buildings and structures or parts thereof used solely for religious purposes.

106.5.1 Annual Inspection of Any Premise Licensed by the Alcohol Beverage Control Commission - ABCC (per St. 2004 c. 304). Any premise, licensed by the ABCC and from which alcoholic beverages are sold and are consumed on the premises, is required to be inspected annually and said annual certificate of inspection is to be signed by the Building Official and by the Head of the Fire Department.

106.5.1.1 Issuance of a Temporary Certificate of Inspection of any Premise Licensed by the Alcohol Beverage Control Commission - ABCC (per St. 2004, c. 304). For premises described in 780 CMR 106.5.1, a building official may issue a temporary certificate of inspection, signed by the head of the fire department; such temporary certificate of inspection shall be identified as effective to a date certain.

106.5.1.1.2 Appeal of the Failure to Issue an Annual Certificate of Inspection of Any Premises Licensed by the Alcohol Beverage Control Commission - ABCC (per St. 2004 c. 304). Failure by the building official to issue an annual certificate of inspection, signed by the head of the fire department, may be appealed in accordance with the requirements of 780 CMR 122.0.

TABLE 106
REQUIRED MINIMUM INSPECTIONS AND CERTIFICATIONS FOR SPECIFIED USE GROUPS
(See 780 CMR 3.00 and 4.00 for complete description of use groups)

Use Group	Use Group	Use Group Description	Minimum Inspections	Maximum Certification Period
A-1	Assembly - Theaters over 400 capacity	With stage and scenery Movie Theater	Semi- Annual Semi- Annual	One Year One Year
A-1	Assembly - Theaters 400 or less capacity	With stage and scenery Movie Theater	Annual Annual	One Year One Year
A-2	Assembly - Night Clubs or similar uses	Over 400 capacity[1] 400 or less capacity[1]	Semi Annual[1] Annual[1]	One Year One Year
A-3	Assembly Lecture Halls, recreation centers, terminals, etc.	Over 400 capacity 400 or less capacity	Semi Annual Annual	One Year One Year
A-4	Assembly	Churches, low density, recreation & similar uses	Prior to issuance of each new certificate	Five Years
A-5	Assembly	Stadiums, bleachers, places of outdoor assembly	Prior to issuance of each new certificate	One Year
"A"	Special Amusement Buildings or portions thereof (780 CMR 413.0)	Special Amusement Buildings or portions thereof (780 CMR 413.7)	Annually prior to issuance of a new certification	One Year
E	Educational	Educational	Prior to issuance of each new certificate	One Year
E	Day Care	Child day care centers (see 780 CMR 4.00)	Prior to issuance of each new certificate	One Year
I-2	Institutional	Incapacitated - hospitals, nursing homes, mental hospitals, certain day care facilities (see 780 CMR 4.00)	Prior to issuance of each new certificate	Two Years
I-3	Institutional	Restrained - prisons, jails, detention centers, etc.	Prior to issuance of each new certificate	Two Years
R-1	Residential	Hotels, motels, lodging houses, dormitories, etc.	Prior to issuance of each new certificate	One Year
R-2	Residential	Multi family	Prior to issuance of each new certificate	Five Years
R-1	Residential Special Occupancy	Detoxification facilities (see 780 CMR 4.00)	Prior to issuance of each new certificate	Two Years
R-2	Residential Special Occupancy	Summer camps for children (see 780 CMR 4.00)	Annual	One Year
R-3 or R-4	Residential Special Occupancy	Group Residence (see 780 CMR 4.00)	Annual	One Year
R-5	Residential Special Occupancy	Limited Group Residence (see 780 CMR 4.00)	Annual	One Year
Any premise[2] that is licensed by the Alcohol Beverage Control Commission (ABCC) and from which alcoholic beverages are sold and consumed on the premises; per M.G.L. c. 10, § 74; also see 780 CMR 106.5.1, 106.5.1.1 and 106.5.1.1.2			Annual (per M.G.L. c. 10, § 74)	One Year (per M.G.L. c. 10, § 74)

Notes applicable to Table 106

Note 1. When appropriate for A-2 USES, the Inspection for the Certificate of Inspection should be timed to satisfy the requirements of M.G.L. c. 10, § 74 (also see the bottom row of Table 106).

Note 2. Premises licensed (via the ABCC) to sell and serve alcohol on the premises include many other USES beyond A-2 USES.

General. The maximum certification period specified in Table 106 is intended to provide administrative flexibility. For those buildings and structures or parts thereof allowing more than one year maximum certification period, the building official may determine the length of validity of the certificate issued. For example, a building in the R-2 use group could be issued a certificate valid for one, two, three, four or five years

780 CMR 107.0 DUTIES AND POWERS OF THE STATE INSPECTOR

(*Refer to M.G.L. c. 143 § 3A*)

107.1 The State Inspector. In every city and town 780 CMR shall be enforced by the State Inspector of the Department of Public Safety, Division of Inspections, as to any structures or buildings or parts thereof that are owned by the Commonwealth or any departments, commissions, agencies, or authorities of the Commonwealth. The state inspector shall have as to such buildings and structures all the powers of a building commissioner or inspector of buildings. All buildings and structures owned by any authority established by the legislature and not owned by the Commonwealth shall be regulated in accordance with 780 CMR 106.0.

107.2 Other Responsibilities. The state inspector shall make periodic reviews of all local building inspection practices, provide technical assistance and advice to the local building officials in the implementation and application of 780 CMR, and report in writing his\her findings to the building officials.

107.3 Review by the Commissioner of Public Safety. The Commissioner of the Commonwealth of Massachusetts, Department of Public Safety shall establish districts which shall be supervised by a state inspector of the Division of Inspections. The Commissioner may review, on his own initiative, or on the application of any state inspector, any action or refusal or failure of action by any building official the result of which does not comply with the uniform implementation of 780 CMR; and may reverse, modify or annul, in whole or in part, such action except with respect to the specialized codes, provided that an order or action of the Commissioner shall not reverse, modify, annul, or contravene any order, action, determination, interpretation or any decision by the BBRS or the State Building Code Appeals Board.

107.4 Reports. The state inspector shall file with the BBRS reports of his periodic reviews and recommendations for improvements of building inspection practices. The format and due dates for these reports shall be determined by the BBRS.

780 CMR 108.0 RULES AND REGULATIONS

108.1 Rule Making Authority. Under authority granted by St. 1984, c. 348 as amended, M.G.L. c. 143, §§ 93 through 100, the BBRS is empowered in the interest of public safety, health and general welfare, to adopt and promulgate rules and regulations, and to interpret and implement the provisions of 780 CMR to secure the intent thereof.

108.2 Amendments and Promulgation of Rules. In accordance with the provisions of M.G.L. c 143, § 97, any person may propose amendments to 780 CMR (refer to 780 CMR 120.P for the proper Form for Code change proposals). Public hearings shall be held at least once each calendar year at times and locations as determined by the BBRS, and at such other times and places as the BBRS may determine, to consider petitions for such amendments. Amendments adopted by the BBRS shall be binding and have the full force and effect in all cities and towns.

108.3 Activities Requiring Licenses, Registration or Certification. The following activities require special license, registration, certification and\or other approval of the BBRS. The referenced special regulations pertaining to such activities are made part of 780 CMR 35.00.

108.3.1 Testing laboratories. A testing laboratory, branch laboratory and/or project laboratory shall not test concrete and/or concrete materials for use in structures subject to construction control (780 CMR 116.0) and/or controlled materials (780 CMR 17.00) unless licensed by the BBRS in accordance with 780 CMR 110.R1: *Concrete Testing Laboratories Licensing*.

108.3.2 Field Technicians. A person shall not engage in the activities of field testing of concrete for use in structures subject to construction control (780 CMR 116.0) and/or controlled materials (780 CMR 17.00) unless such person is licensed by the BBRS in accordance with 780 CMR 110.R2: *Concrete Testing Personnel Licensing*.

108.3.3 Manufactured Buildings. No individual, organization or firm shall be engaged in the construction of manufactured buildings for use in the Commonwealth of Massachusetts unless approved to construct same by the BBRS in accordance with 780 CMR 110.R3: *Manufactured Buildings, Building Components and Mobile Homes*.

108.3.4 Native Lumber. No individual, organization or firm shall engage in the production of native lumber for use in structures within the Commonwealth of Massachusetts unless registered by the BBRS in accordance with 780 CMR 110.R4: *Use of Native Lumber*.

108.3.5 Licensing of Construction Supervisors.

108.3.5.1. Except for those structures governed by Construction Control in 780 CMR 116.0, effective July 1, 1982, no individual shall be engaged in directly supervising persons engaged in construction, reconstruction, alteration, repair, removal or demolition involving any activity regulated by any provision of 780 CMR, unless said individual is licensed in accordance the Rules and Regulations for Licensing Construction Supervisors as set forth in 780 CMR 110.R5: *Construction Supervisors*.

All persons engaged in the supervision of the field erection of a manufactured building shall be licensed in accordance with 780 CMR 110.R5: *Construction Supervisors*.

Exception. Any Home Owner performing work for which a building permit is required shall be exempt from the licensing provisions of 780 CMR 108.3.5; provided that if a Home Owner engages a person(s) for hire to do such work, that such Home Owner shall act as supervisor. This exception shall not apply to the field erection of a manufactured buildings constructed pursuant to 780 CMR 35.00 and 780 CMR 110.R3. For the purposes of 780 CMR 108.3.5, a "Homeowner" is defined as follows: Person(s) who owns a parcel of land on which he/she resides or intends to reside, on which there is, or is intended to be, a one or two family dwelling, attached or detached structures accessory to such use and/or farm structures. A person who constructs more than one home in a two-year period shall not be considered a home owner.

Note: Any Licensed Construction Supervisor who contracts to do work for a home owner shall be responsible for performing said work in accordance with 780 CMR 110.R5: *Construction Supervisors* and all reference standards and\or manufacture's recommendations, whether or not the licensed contractor secured the permit for said work.

108.3.5.2 Exemptions from Construction Supervisor License Requirement. A construction supervisor's license is not required for:

1. erection of rooftop solar collectors, construction of above ground swimming pools, the erection of signs, the erection of tents;
2. projects which are subject to construction control (780 CMR 116.0);
3. agricultural buildings which are not open to the public or otherwise made available for public use;
4. Massachusetts registered engineers and Massachusetts registered architects provided such engineers and/or architects comply with the Construction Supervisor oversight requirements set forth in 780 CMR R5 generally and 780 CMR R5.2.12, as applicable;
5. the practice of any trade licensed by agencies of the commonwealth (see M.G.L. c. 112, §81R), provided that any such work is within the scope of said license, including, but not limited to wiring, plumbing gas fitting, fire protection systems, pipefitting, HVAC and refrigeration equipment.

108.3.5.3. No municipality shall be prohibited from requiring a license for those individuals engaged in directly supervising persons engaged in construction, reconstruction, alteration, repair, removal or demolition in those categories of building and structures for which the BBRS does not require a license, provided that those municipalities which have established licensing requirements for construction supervisors prior to January 1, 1975, may maintain their existing licensing requirements.

108.3.6 Registration of Home Improvement Contractors. In accordance with the provisions of M.G.L. c. 142A, no home improvement contractor, or organization or firm shall be involved in the improvement of any existing owner occupied one to four family residential building unless said home improvement contractor has registered with the BBRS in accordance with the rules and regulations for the registration of Home Improvement Contractors as set forth in 780 CMR 110.R6: *Registration and Enforcement of Home Improvement Contractor Program.*

108.3.7 Certification of Inspectors of Buildings, Building Commissioners and Local Inspectors; Except as allowed for conditional appointees, no individual shall perform the duties of a municipal inspectors of buildings, building commissioners or local inspectors unless certified by the BBRS as set forth in 780 CMR 110.R7: *Certification of Inspectors of Buildings, Building Commissioners and Local Inspectors*.

108.4 Enforcement. Whoever violates the provisions of 780 CMR 108.0 or any rules and regulations promulgated hereunder, or who falsifies or counterfeits a license, registration or certification issued by the BBRS, or who fraudulently issues or accepts such a license, registration or certification shall be punished as provided in 780 CMR 118.0 and\or shall be subject to any other penalty provided for by law.

780 CMR 109.0 APPROVAL

109.1 Approved Materials and Equipment. All materials, equipment and devices approved by the building official shall be constructed and installed in accordance with such approval.

109.2 Used Materials and Equipment. Used materials, equipment and devices which meet the minimum requirements of 780 CMR for new materials, equipment and devices shall be permitted; however, the building official may require satisfactory proof that such materials, equipment and devices have been reconditioned, tested, and/or placed in good and proper working condition prior to approval.

109.3 Minor Modifications. Wherever there are practical difficulties involved in carrying out minor provisions of 780 CMR, the building official shall have the authority to grant modifications for individual cases, provided the building official shall first find that special individual reasons make the strict letter of 780 CMR impractical and the modification is in compliance with the intent and purpose of 780 CMR and that such modification does not affect health, life, fire safety, means of egress, or structural requirements. The details of actions granting modifications shall be recorded and entered in the files of the building department. A building official shall seek assistance from the District State Building Inspector for action under 780 CMR 109.0. Any minor modifications allowed by the building official shall be documented as part of the application, a copy of which shall be transmitted to the BBRS.

109.3.1 Areas Prone to Flooding. The building official shall not grant modifications to any provision related to areas prone to flooding as established by 780 CMR without the granting of a variance to such provisions by the BBRS Building Code Appeals Board as defined in 780 CMR 122.0; additionally, no variance to requirements of the Building Code can be solely utilized to argue for lawful building and structure construction/reconstruction where such construction/reconstruction would result in conflict with requirements of M.G.L. c. 131, § 40: *Removal, Fill, Dredging or Altering of Land Bordering Waters* (the Wetlands Protection Act), and/or 310 CMR and 314 CMR, as applicable.

109.4 Alternative Materials and Equipment.

109.4.1 General. The provisions of 780 CMR are not intended to limit the appropriate use or installation of materials, appliances, equipment or preclude methods of design or construction not specifically prescribed by 780 CMR, provided that any such alternative has been approved. Alternative materials, appliances, equipment or methods of design or construction shall be approved when the building official is provided acceptable proof and has determined that said alternative is satisfactory and complies with the intent of the provisions of 780 CMR, and that said alternative is, for the purpose intended, at least the equivalent of that prescribed in 780 CMR in quality, strength, effectiveness, fire resistance, energy efficiency, durability and safety. Compliance with specific performance based provisions of 780 CMR, in *lieu* of a prescriptive requirement shall also be permitted as an alternate.

109.4.2 Evidence Submitted. The building official may require that evidence or proof be submitted to substantiate any claims that may be made regarding the proposed alternate.

109.4.3 Tests. Determination of acceptance shall be based on design or test methods or other such standards approved by the BBRS. In the alternative, where the BBRS has not provided specific approvals, the building official may accept, as supporting data to assist in this determination, duly authenticated engineering reports, formal reports from nationally acknowledged testing/ listing laboratories and/or reports from other accredited sources including consideration of recognized National Model Code "national evaluation reports". The costs of all tests, reports and investigations required under 780 CMR 109.4.3 shall be borne by the applicant.

109.4.4 Approval by the Construction Materials Safety Board. The building official may refer such matters to the Construction Materials Safety Board in accordance with 780 CMR 123.0 for approval.

780 CMR 110.0 APPLICATION FOR PERMIT

110.1 Permit Application. It shall be unlawful to construct, reconstruct, alter, repair, remove or demolish a building or structure; or to change the use or occupancy of a building or structure; or to install or alter any equipment for which provision is made or the installation of which is regulated by 780 CMR without first filing a written application with the building official and obtaining the required permit therefor.

110.2 Temporary Structures.

110.2.1 General. A building permit shall be required for temporary structures, unless exempted by 780 CMR 110.3. Such permits shall be limited as to time of service, but such temporary construction shall not be permitted for more than one year.

110.2.2 Special Approval. All temporary construction shall conform to the structural strength, fire safety, means of egress, light, ventilation, energy conservation and sanitary requirements of 780 CMR as necessary to insure the public health, safety and general welfare.

110.2.3 Termination of Approval. The building official may terminate such special approval and order the demolition or removal of any such construction at the discretion of the building official.

110.3 Exemptions. A building permit is not required for the following activities, such exemption, however, shall not exempt the activity from any review or permit which may be required pursuant to other laws, by-laws, rules and regulations of other jurisdictions (e.g. zoning, conservation, etc.).

1. One story detached accessory buildings used as tool or storage sheds, playhouses and similar uses, provided the floor area does not exceed 120 square feet.
2. Fences six feet in height or less.
3. Retaining walls which, in the opinion of the building official, are not a threat to the public safety health or welfare and which retain less than four feet of unbalanced fill.
4. Ordinary repairs as defined in 780 CMR 2.00.

Ordinary repairs shall not include the cutting away of any wall, partition or portion thereof, the removal or cutting of any structural beam, column or other loadbearing support, or the removal or change of any required means of egress, or rearrangement of parts of a structure affecting the egress requirements; nor shall ordinary repairs include addition to, alteration of, replacement or relocation of any standpipe, water supply, mechanical system, fire protection system, energy conservation system or other work affecting public health or general safety.

Note. Also see 780 CMR 901.7.1 (Exceptions 1. and 2.) and M.G.L. 148, § 27A.

5. **Greenhouses**. A building permit or notice to the building official is not required for the construction of greenhouses covered exclusively with plastic film (in accordance with St. 1983, c. 671). (This exemption does not apply if the greenhouse is to be used for large assemblies of people or uses other than normally expected for this purpose.)

110.4 Form of Application. Applicants shall submit requests for building permits only on the uniform building permit application form contained in 780 CMR 120.P: *Standard Forms and Applications* or on a form that has been approved by the BBRS for such purpose (Municipal Building Permit Forms are acceptable, if, as a minimum, such Municipal Building Permit Forms contain all of the information presented in the sample Building Permit Form in 780 CMR 120.P: *Standard Forms and Applications*). The application for a permit shall be accompanied by the required fee as prescribed in 780 CMR 114.0. At a minimum, all applications shall:

1. Identify and describe the work to be covered by the permit for which application is made.
2. Describe the land on which the proposed work is to be done by legal description, street address or similar description that will readily identify and definitely locate the proposed building or work.
3. Indicate the use and occupancy for which the proposed work is intended.
4. Be accompanied by construction documents and other information as required in 780 CMR 110.7 and 110.8 and elsewhere in 780 CMR.
5. State the valuation of the proposed work.
6. Be signed by the applicant, or the applicant's authorized agent.

110.5 By Whom Application is Made. Application for a permit shall be made by the owner or lessee of the building or structure, or agent of either. If application is made other than by the owner, the written authorization of the owner shall accompany the application. Such written authorization shall be signed by the owner , or shall grant permission to the lessee to apply for the permit. The full names and addresses of the owner, lessee, applicant and the responsible officers, if the owner or lessee is a corporate body, shall be stated in the application.

Note. It shall be the responsibility of the registered contractor to obtain all permits necessary for work covered by the Home Improvement Contractor Registration Law, M.G.L. c. 142A. An owner who secures his or her own permits for such shall be excluded from the guaranty fund provisions as set forth in M.G.L. c. 142A. Refer to 780 CMR 110.R6 and M.G.L. c. 142A for additional information regarding the Home Improvement Contractor Registration Program.

110.6. The securing of a building permit by the owner, or the owner's authorized agent, to construct, reconstruct, alter, repair, demolish, remove, install equipment or change the use or occupancy of a building or structure, shall not be construed to relieve or otherwise limit the duties and responsibilities of the licensed, registered or certified individual or firm under the rules and regulations governing the issuance of such license registration or certification.

110.7 Construction Documents. The application for permit shall be accompanied by not less than three sets of construction documents. When 780 CMR 116.0 is applicable, only one set of construction documents need bear the original signature and original (wet) seal. The building official is permitted to waive, or modify the requirements for filing construction documents when the building official determines that the scope of the work is of a minor nature. When the quality of the materials is essential for conformity to 780 CMR, specific information shall be given to establish such quality, and 780 CMR shall not be cited, or the term "legal" or its equivalent used as a substitute for specific information.

Construction documents shall be drawn upon suitable material. Electronic media documents are permitted to be submitted when approved by the building official. Construction documents shall be of sufficient clarity to indicate the location, nature and extent of the work proposed and show in detail that the work will conform to the provisions of 780 CMR and relevant laws, ordinances, rules and regulations, as determined by the building official.

110.7.1 Architectural Preparation of Construction Documents. In accordance with M.G.L. c 112 § 60L, detached one- and two-family dwellings are not required to be prepared by a registered architect, except as modified by 780 CMR 110.7.3.

110.7.2 Engineering Preparation of Construction Documents. In accordance with M.G.L. c 112, §81D *et seq*, the design of any structural member which is not prescriptively identified in 780 CMR requires the services of a registered professional engineer. A building official shall require engineering plans, specifications, calculations, and\or details of sufficient clarity to indicate that such engineering work will conform to the provisions of 780 CMR and relevant laws, ordinances, rules and regulations.

110.8 Engineering Details, Reports, Calculations, Plans and Specifications. In the application for a permit for buildings and structures , the construction documents shall contain sufficient plans and details to fully describe the work intended, including, but not limited to all details sufficient to describe the structural, fire protection, fire alarm, mechanical, light and ventilation, energy conservation, architectural access and egress systems. The building official may require such calculations, descriptions narratives and reports deemed necessary to fully describe the basis of design for each system regulated by 780 CMR. In accordance with the provisions of M.G.L. c. 143, § 54A all plans and specifications shall bear the original seal and original signature of a Massachusetts registered professional engineer or registered architect responsible for the design, except as provided in M.G.L. c. 143, § 54A and any profession or trade as provided in M.G.L. c. 112, § 60L and M.G.L. c. 112, § 81R.

When such application for permit must comply with the provisions of 780 CMR 4.00 or 780 CMR 9.00 or 780 CMR 34.00, the building official (municipal and\or state) shall cause one set of construction documents filed pursuant to 780 CMR 110.7 to be transmitted simultaneously to the head of the local fire department for his file, review and approval of the items specified in 780 CMR 901.7.1 as they relate to the applicable sections of 780 CMR 4.00, 780 CMR 9.00 or 780 CMR 34.00. The head of the local fire department shall within ten working days from the date of receipt by him, approve or disapprove such construction documents. If the head of the local fire department disapproves such construction documents, he or she shall do so, in writing citing the relevant sections of noncompliance with 780 CMR or the sections of the referenced standards of 780 CMR 35.00. Upon the request of the head of the local fire department, the building official may grant one or more extensions of time for such review provided, however, that the total review by said head of the local fire department shall not exceed 30 Calendar days. If such approval, disapproval or request for extension of time is not received by the building official within said ten working days, the building official may deem the construction documents to be in full compliance with the applicable sections of 780 CMR 4.00, 780 CMR 9.00 or 780 CMR 34.00 and, therefore approved by the head of the local fire department.

Note that for one- and two-family buildings, refer to 780 CMR 51.00 through 99.00, the 7th Edition Massachusetts Building Code for One- and Two-Family Dwellings.

110.9 Existing Buildings. The application for a building permit to reconstruct, alter or change the use or occupancy of existing buildings or structures which are subject to construction control pursuant to 780 CMR 116.0, shall be accompanied by a building survey where required by 780 CMR 34.00 and/or 780 CMR 120.S: *Reference Data for Repair, Alteration and Change of Use of Existing Buildings*.

110.10 Site Plan. A site plan shall be filed showing, to scale, the size and location of all new construction and all existing structures on the site, distances from lot lines, the established street grades and the proposed finished grades; and it shall be drawn in accordance with an accurate boundary line survey. In the case of demolition, the site plan shall show all construction to be demolished and the location and size of all existing structures and construction that are to remain on the site or plot.

110.11 Independent Structural Engineering Review.

110.11.1 Condition for Permit. As a condition for the issuance of a building permit, the structural design of the following described structures shall be reviewed by an independent structural engineer to verify that the design of the primary structure is conceptually correct and that there are no major errors in the design:

1. New buildings and structurally separate additions which are five stories or more in *height* above the lowest floor, including stories below grade.
2. New buildings and structurally separate additions which enclose a total volume of 400,000 cubic feet, including stories below grade. The volume shall be measured using the outside dimensions of the *building*.
3. New or existing structures in or partially in *Use Group* A used for public assembly of 300 or more persons.
4. Existing buildings which enclose a total volume of 200,000 cubic feet, including stories below grade, for what 780 CMR 34.00 defines as Level 3, 4, and 5 Work.
5. Existing buildings which enclose a total volume of 200,000 cubic feet, including stories below grade, for what 780 CMR 34.00 defines as Level 2 Work, except that the required review shall be limited to the lateral load resisting system.
6. Structures of unusual complexity or design as shall be determined by the BBRS. A building official may apply to the BBRS for such a determination on a specific structure.

110.11.2 Requirements for the Review. The independent structural engineering review shall be in accordance with the requirements of 780 CMR 120.U: *Independent Structural Engineer Review*.

110.11.3 Disputes. Disputes between the structural engineer responsible for the design of the *building* or *structure* and the structural engineering peer reviewer shall be resolved by the Structural Peer Review Advisory Committee in accordance with 780 CMR 125.0.

110.12 Structures Subject to Control. In those structures subject to control as required in 780 CMR 116.0, documentation must be submitted with the permit application that affirm, where applicable, that the individuals and testing laboratories responsible for carrying out the duties specified in 780 CMR 116.0 have been licensed by the BBRS.

110.13 Amendments to Application. Subject to the limitations of 780 CMR 110.14, amendments to a plan, application or other records accompanying the same shall be filed prior to the commencement of the work for which the amendment to the permit is sought or issued. Such amendments shall be deemed part of the original application and shall be submitted in accordance with 780 CMR 110.0.

110.14 Time Limitation of Application. An application for a permit for any proposed work shall be deemed to have been abandoned six months after the date of filing, unless such application has been diligently prosecuted or a permit shall have been issued; except that the building official shall grant one or more extensions of time for additional periods not exceeding 90 days each if there is reasonable cause and upon written request by the owner.

780 CMR 111.0 PERMITS

111.1 Action on Application. The building official shall examine or cause to be examined all applications for permits and amendments thereto within 30 days after filing thereof. If the application or the construction documents do not conform to the requirements of 780 CMR and all pertinent laws under the building official's jurisdiction, the building official shall reject such application in writing, stating the reasons therefor. If the building official is satisfied that the proposed work conforms to the requirements of 780 CMR and all laws and ordinances applicable thereto, the building official shall issue a permit therefor.

111.2 Zoning. In accordance with the provisions of M.G.L. c. 40A or St. 1956, c. 665 as amended, no permit for the construction, alteration, change of use or moving of any building or structure shall be issued if such building or structure or use would be in violation of any zoning ordinance or by-law.

111.3 Railroad Right-of-way. No permit to build a structure of any kind on land formerly used as a railroad right-of-way or any property appurtenant thereto formerly used by any railroad company in the state shall be issued without first obtaining, after public hearing, the consent in writing to the issuance of such permit from the Secretary of the Executive Office of Transportation and Construction, all in accordance with M.G.L. c. 40, § 54A.

111.4 Water Supply. No permit shall be issued for the construction of a building or structure which would necessitate the use of water therein, unless a supply of water is available therefore, either from a water system operated by a city, town or district, or from a well located on the land where the building or structure is to be constructed, or from a water corporation or company, as required by M.G.L. c. 40, § 54; also refer to DEP Regulations 310 CMR 22.00 and/or 310 CMR 36.00, when applicable.

111.5 Debris. As a condition of issuing a permit for the demolition, renovation, rehabilitation or other alteration of a building or structure, M.G.L. c. 40, § 54 requires that the debris resulting there from shall be disposed of in a properly licensed solid waste disposal facility as defined by M.G.L. c. 111, § 150A. Signature of the permit applicant, date and number of the building permit to be issued shall be indicated on a form provided by the building department, and attached to the office copy of the building permit retained by the building department. If the debris will not be disposed of as indicated, the holder of the permit shall notify the building official, in writing, as to the location where the debris will be disposed; also refer to DEP Regulations 310 CMR 7.09(2) and 310 CMR 7.15, when applicable.

111.6 Workers' Compensation. No permit shall be issued to construct, reconstruct, alter or demolish a building or structure until acceptable proof of insurance pursuant to M.G.L. c. 152, § 25C(6) has been provided to the building official.

111.7 Hazards to Air Navigation. Application for building new structures or adding to existing structures within airport approaches as defined in M.G.L. c. 90, §35B and any amendments thereto or language substituted therefore, must include a certification by the applicant that:

1. Either a permit from the Massachusetts Aeronautics Commission is not required because the structure is, or will be;
    (a) In an area subject to airport approach regulations adopted pursuant to M.G.L. c. 90, §§ 40A through 40I, or;
    (b) in an approach to Logan International Airport, or;
    (c) less than 30 feet above ground level, or;
2. A permit from the Massachusetts Aeronautics Commission is required pursuant to M.G.L. c. 90, § 35B and a copy of said permit is enclosed with the application.

Applications for permits to build a new structure or add to an existing structure requiring the filing of a Notice of Proposed Construction or Alteration (FAA Form 7460-1) with the Federal Aviation Commission shall mail a copy of the completed FAA Form 7460-1 to the Massachusetts Aeronautic Commission within three business days after submitting said form to the FAA.

111.8 Expiration of Permit. Any permit issued shall be deemed abandoned and invalid unless the work authorized by it shall have been commenced within six months after its issuance; however, for cause, and upon written request of the owner, one or more extensions of time, for periods not exceeding six months each, may be granted in writing by the building commissioner or inspector of buildings. Work under such a permit in the opinion of the building commissioner or inspector of buildings, must proceed in good faith continuously to completion so far as is reasonably practicable under the circumstances. It is the sole responsibility of the owner to inform, in writing, the building commissioner or inspector of buildings of any facts which support an extension of time. The building commissioner or inspector of buildings has no obligation under 780 CMR 111.7 to seek out information which may support an extension of time. The owner may not satisfy this requirement by informing any other municipal and/or state official or department.

For purposes of 780 CMR 111.7 any permit issued shall not be considered invalid if such abandonment or suspension of work is due to a court order prohibiting such work as authorized by such permit; provided, however, in the opinion of the building commissioner or inspector of buildings, the person so prohibited by such court order, adequately defends such action before the court.

111.9 Previous Approvals. 780 CMR shall not require changes in the construction documents, construction or designated use group of a building for which a lawful permit has been heretofore issued or otherwise lawfully authorized, and the construction of which has been actively prosecuted within 180 days after the effective date of 780 CMR and is completed with dispatch.

111.10 Signature to Permit. The building official's signature shall be attached to every permit; or the building official shall authorize a subordinate to affix such signature thereto.

111.11 Approved Construction Documents. When the building official has determined that the proposed construction conforms to the provisions of 780 CMR and other applicable laws, by-laws, rules and regulations under his/her jurisdiction, the building official shall stamp or endorse in writing the three sets of construction documents "Approved". One set of the approved construction documents shall be retained by the building official, one set by the head of the local fire department and the other set shall be kept at the construction site, open to inspection of the building official or an authorized representative at all reasonable times.

111.12 Revocation of Permits. The building official shall revoke a permit or approval issued under the provisions of 780 CMR in case of any false statement or misrepresentation of fact in the application or on the plans on which the permit or approval was based.

111.13 Approval in Part. The building official may issue a permit for the construction of foundations or any other part of a building or structure before the construction documents for the whole building or structure have been submitted, provided that adequate information and detailed statements have been filed complying with all of the pertinent requirements of 780 CMR. Work shall be limited to that work approved by the partial approval and further work shall proceed only when the building permit is amended in accordance with 780 CMR 110.13. The holder of such permit for the foundation or other parts of a building or structure shall proceed at the holder's own risk with the building operation and without assurance that a permit for the entire building or structure will be granted.

111.14 Posting of Permit. A true copy of the building permit shall be kept on the site of operations, open to public inspection during the entire time of prosecution of the work and until the completion of the same.

111.15 Notice of Start. At least 24-hour notice of start of work under a building permit shall be given to the building official.

780 CMR 112.0 DEMOLITION OF STRUCTURES

112.1 Service Connections. Before a building or structure is demolished or removed, the owner or agent shall notify all utilities having service connections within the structure such as water, electric, gas, sewer and other connections. A permit to demolish or remove a building or structure shall not be issued until a release is obtained from the utilities, stating that their respective service connections and appurtenant equipment, such as meters and regulators, have been removed or sealed and plugged in a safe manner. All debris shall be disposed of in accordance with 780 CMR 111.5.

112.2 Notice to Adjoining Owners. Only when written notice has been given by the applicant to the owners of adjoining lots and to the owners of wired or other facilities, of which the temporary removal is necessitated by the proposed work, shall a permit be granted for the removal of a building or structure.

112.3 Lot Regulation. Whenever a building or structure is demolished or removed, the premises shall be maintained free from all unsafe or hazardous conditions by the proper regulation of the lot, restoration of established grades and the erection of the necessary retaining walls and fences in accordance with the provisions of 780 CMR 33.00.

780 CMR 113.0 CONDITIONS OF PERMIT

113.1 Payment of Fees. A permit shall not be issued until the fees prescribed in 780 CMR 114.0 have been paid.

113.2 Compliance with Code. The permit shall be a license to proceed with the work and shall not be construed as authority to violate, cancel or set aside any of the provisions of 780 CMR or any other law or regulation, except as specifically stipulated by modification or legally granted variation as described in the application.

113.3 Compliance with Permit. All work shall conform to the approved application and the approved construction documents for which the permit has been issued and any approved amendments to the approved application or the approved construction documents.

113.4 Compliance with Site Plan. All new work shall be located strictly in accordance with the approved site plan.

780 CMR 114.0 FEES

114.1 General. A permit to begin work for new construction, alteration, removal, demolition or other building operation shall not be issued until the fees prescribed in 780 CMR 114.0 shall have been paid to the department of building inspection or other authorized agency of the jurisdiction, nor shall an amendment to a permit necessitating an additional fee be approved until the additional fee has been paid.

114.2 Special Fees. The payment of the fee for the construction, alteration, removal or demolition for all work done in connection with or concurrently with the work contemplated by a building permit shall not relieve the applicant or holder of the permit from the payment of other fees that are prescribed by law or ordinance for water taps, sewer connections, electrical permits, erection of signs and display structures, marquees or other appurtenant structures, or fees of inspections, certificates of occupancy or other privileges or requirements, both within and without the jurisdiction of the department of building inspection.

114.3 New Construction and Alterations. The fees for plan examination, building permit and inspections shall be as prescribed in 780 CMR 114.3.1 and the building official is authorized to establish by approved rules a schedule of unit rates for buildings and structures of all use groups and types of construction as classified and defined in 780 CMR 1.00, 3.00 and 6.00.

114.3.1 Fee Schedule. A fee for each plan examination, building permit and inspection shall be paid in accordance with the fee schedule as established by the municipality.

114.4 Accounting. The building official shall keep an accurate account of all fees collected; and such collected fees shall be deposited in the jurisdiction treasury in accordance with procedures established by the municipality, or otherwise disposed of as required by law.

780 CMR 115.0 INSPECTION

115.1 Preliminary Inspection. Before issuing a permit, the building official shall, if deemed necessary, examine or cause to be examined all buildings, structures and sites for which an application has been filed for a permit to construct, enlarge, alter, repair, remove, demolish or change the use or occupancy thereof.

115.2 Required Inspections. After issuing a building permit, the building official shall conduct inspections during construction at intervals sufficient to ensure compliance with the provisions of 780 CMR. The building official shall inform the applicant of the required points of inspection at the time of application. Upon completion of the work for which a permit has been issued, the building official shall conduct a final inspection pursuant to 780 CMR 115.5. A record of all such examinations and inspections and of all violations of 780 CMR shall be maintained by the building official. For buildings and structures subject to construction control, the owner shall provide for special inspections in accordance with 780 CMR 1705.0.

In conjunction with specific construction projects, the building official may designate specific inspection points in the course of construction that require the contractor or builder to give the building official 24 hours notice prior to the time when those inspections need to be performed. The building official shall make the inspections within 48 hours after notification.

115.3 Approved Inspection Agencies. The building official may accept reports of approved inspection agencies provided such agencies satisfy the requirements as to qualifications and reliability.

115.4 Plant Inspection. Where required by the provisions of 780 CMR or by the approved rules, materials or assemblies shall be inspected at the point of manufacture or fabrication in accordance with 780 CMR 1703.3.

115.5 Final Inspection. Upon completion of the building or structure, and before issuance of the certificate of occupancy required by 780 CMR 120.0, a final inspection shall be made. All variations of the approved construction documents and permit shall be noted and the holder of the permit shall be notified of the discrepancies.

115.6 General. In the discharge of his duties, the building official shall have the authority to enter at any reasonable hour any building, structure or premises in the municipality to enforce the provisions of 780 CMR. If any owner, occupant, or other person refuses, impedes, inhibits, interferes with, restricts, or obstructs entry and free access to every part of the structure, operation or premises where inspection authorized by 780 CMR is sought, the building official, or state inspector may seek, in a court of competent jurisdiction, a search warrant so as to apprise the owner, occupant or other person concerning the nature of the inspection and justification for it and may seek the assistance of police authorities in presenting said warrant.

115.7 Identification. The building official shall carry proper identification when inspecting structures or premises in the performance of duties under 780 CMR.

115.8 Jurisdictional Cooperation. The assistance and cooperation of police, fire, health departments, conservation commissions, and all other officials shall be available to the building official as required in the performance of his duties.

115.9 Coordination of Inspections. Whenever in the enforcement of 780 CMR or another code or ordinance, the responsibility of more than one building official of the jurisdiction is involved, it shall be the duty of the building officials involved to coordinate their inspections and administrative orders as fully as practicable so that the owners and occupants of the building or structure shall not be subjected to visits by numerous inspectors or multiple or conflicting orders. Whenever an inspector from any agency or department observes an apparent or actual violation of some provision of some law, ordinance or code not within the inspector's authority to enforce, the inspector shall report the findings to the building official having jurisdiction.

780 CMR 116.0 REGISTERED ARCHITECTURAL AND PROFESSIONAL ENGINEERING SERVICES - CONSTRUCTION CONTROL

116.1 General. The provisions of 780 CMR 116.0 define the construction controls required for all buildings and structures needing registered architectural or registered professional engineering services, and delineate the responsibilities of such professional services together with those services that are the responsibility of the contractor during construction.

The following structures are exempt from the requirements of 780 CMR 116.0:

1. Any *building* containing less than 35,000 cubic feet of enclosed space, measured to the exterior surfaces of walls and *roofs* and to the top of a ground supported floor, or in the case of a crawl space, to the bottom surface of the crawl space. In the case of basement floors or levels, the calculation of enclosed space shall include such spaces. For additions to existing buildings, the volume of enclosed space shall include the entire existing building and all proposed additions.
2. Any single or two family dwelling or any accessory building thereto;
3. Any building used exclusively for farm purposes (this exemption does not apply if the building is to be used for large assemblies of people or uses other than farm purposes); and
4. Retaining walls less than ten feet in height at all points along the wall as measured from the base of the footing to the top of the wall.

Notwithstanding the exemptions on 780 CMR 116.1 1. through 4., professional engineering services shall be required for activities which are deemed to constitute the practice of engineering as defined in M.G.L. c. 112, § 81D, except as provided in M.G.L. c. 54A and any legally required profession or as provided in M.G.L. c. 112, § 81R.

116.1.1 Specialized Structures Requiring Construction Control. Telecommunication towers, wind turbine towers, and similar structures are engineered structures and shall be subject to the requirements of 780 CMR 116.

116.2 Registered Architectural and Engineering Services.

116.2.1 Design. All plans, computations and specifications involving new construction, alterations, repairs, expansions or additions or change in use or occupancy of existing buildings shall be prepared by or under the direct supervision of a Massachusetts registered architect or Massachusetts registered professional engineer and shall bear his or her signature and seal or by the legally recognized professional performing the work, as defined by M.G.L. c. 112, § 81R. Said signature and seal shall signify that the plans, computations and specifications meet the applicable provisions of 780 CMR and all accepted engineering practices. Only one set of construction documents need bear the original signature and original (wet) seal.

116.2.2 Architect/Engineer Responsibilities During Construction. The registered architects and registered professional engineers who are responsible for the design, plans, calculations, and specifications, or their designee, shall perform the following tasks:

1. Review, for conformance to the design concept, shop drawings, samples and other submittals by the contractor in accordance with the requirements of the construction documents.

2. Review and approval of the quality control procedures for all code-required controlled materials.
3. Be present at intervals appropriate to the stage of construction to become, generally familiar with the progress and quality of the work and to determine, in general, if the work is being performed in a manner consistent with the construction documents.

The application of the permit shall not be deemed to be complete until all of the Construction Control Documents (as defined in 780 CMR 2.00 and 780 CMR 116.2.1) have been submitted (also see 780 CMR 110.0).

Final documentation of the compliance of the work per the plans and specifications shall be provided, and, when required by the Building Official, at the completion of each phase of construction.

116.2.3 Structural Tests and Inspections. Structural tests and inspection shall be provided in accordance with 780 CMR 1705.0.

116.2.4 Tests and Inspections of Non Structural Systems. Tests and inspections of non structural systems shall be performed in accordance with applicable engineering practice standards or referenced standards listed in 780 CMR 35.00.

116.3 Construction Contractor Services. The actual construction of the work shall be the responsibility of the general contractor as identified on the approved building permit and shall involve the following:

1. Execution of all work in accordance with the approved construction documents.
2. Execution and control of all methods of construction in a safe and satisfactory manner in accordance with all applicable local, state, and federal statutes and regulations.
3. Upon completion of the construction, he shall certify in writing to the Architect/Engineer of record that, to the best of his knowledge and belief, such has been done in substantial accord with 780 CMR 116.3.1 and .2 and with all pertinent deviations specifically noted. The Building Official may require a copy of this certification.

116.4 On Site Project Representation. When applications for unusual designs or magnitude of construction are filed, or where reference standards require special architectural or engineering inspections, the building official may require full-time project representation by a registered architect or professional engineer in addition to that provided in 780 CMR 116.2.2. The project representative shall keep daily records and submit reports as may be required by the building official. Upon completion of the work, the registered architect or professional engineer shall file a final report indicating that the work has been performed in accordance with the approved plans and 780 CMR.

116.4.1 Building Permit Requirement. This on-site project representation requirement shall be determined prior to the issuance of the building permit and shall be a requisite for the permit issuance. Refusal by the applicant to provide such service as required by the building official shall result in the denial of the permit. However, the applicant may file an appeal as provided in 780 CMR 122.0.

116.4.2 Fee and Costs. All fees and costs related to the performance of on-site project representation shall be borne by the owner.

116.5 Building Official Responsibility. Nothing contained in 780 CMR 116.0 shall have the effect of waiving or limiting the building official's authority to enforce 780 CMR with respect to examination of the contract documents, including plans, computations and specifications, and field inspections (see 780 CMR 106.0).

780 CMR 117.0 WORKMANSHIP

117.1 General. All work shall be conducted, installed and completed in a workmanlike and acceptable manner so as to secure the results intended by 780 CMR.

780 CMR 118.0 VIOLATIONS

118.1 Unlawful Acts. It shall be unlawful for any person, firm or corporation to use, occupy or change the use or occupancy of any building or structure or to erect, construct, alter, extend, repair, remove, demolish any building or structure or any equipment regulated by 780 CMR, or cause same to be done, in conflict with or in violation of any of the provisions of 780 CMR.

118.2 Notice of Violation. The building official shall serve a notice of violation or order on the person responsible for the erection, construction, alteration, extension, repair, removal, demolition or occupancy of a building or structure in violation of the provisions of 780 CMR, or in violation of a detail statement or a plan approved thereunder, or in violation of a permit or certificate issued under the provisions of 780 CMR. Such order shall be in writing and shall direct the discontinuance of the illegal action or condition and the abatement of the violation.

118.3 Prosecution of Violation. If the notice of violation is not complied with in the time period specified in said notice of violation, the building official may institute the appropriate proceedings at law or in equity to restrain, correct or abate such violation or to require the removal or termination of the unlawful occupancy of the building or structure in violation of the provisions of 780 CMR or of the order or direction made pursuant thereto.

118.4 Violation Penalties. Whoever violates any provision of 780 CMR, except any specialized code referenced herein, shall be punishable by a fine of not more than $1,000 or by imprisonment for not more than one year, or both for each such violation. Each day during which a violation exists shall constitute a separate offense. The building official shall not begin criminal prosecution for such violations until the lapse of 30 days after the issuance of the written notice of violation.

118.5 Abatement of Violation. The imposition of the penalties herein prescribed shall not preclude the legal officer of the jurisdiction from instituting appropriate action to prevent unlawful construction or to restrain, correct or abate a violation, or to prevent illegal occupancy of a building, structure or premises or to stop an illegal act, conduct, business or occupancy of a building or structure on or about any premises.

118.6 Notice or Orders, Service and Content. Every notice or order authorized by 780 CMR shall be in writing and shall be served on the person responsible:

1. personally, by any person authorized by the building official; or
2. by any person authorized to serve civil process by leaving a copy of the order or notice at the responsible party's last and usual place of abode; or
3. by sending the party responsible a copy of the order by registered or certified mail return receipt requested, if he is within the Commonwealth; or
4. if the responsible party's last and usual place of abode is unknown, by posting a copy of this order or notice in a conspicuous place on or about the premises in violation and by publishing it for at least three out of five consecutive days in one or more newspapers of general circulation wherein the building or premises affected is situated.

780 CMR 119.0 STOP WORK ORDER

119.1 Notice to Owner. Upon notice from the building official that work on any building or structure is being prosecuted contrary to the provisions of 780 CMR or in an unsafe and dangerous manner or contrary to the approved construction documents submitted in support of the building permit application, such work shall be immediately stopped. The stop work order shall be in writing and shall be given to the owner of the property involved, or to the owner's agent, or to the person doing the work; and shall state the conditions under which work will be permitted to resume.

119.2 Unlawful Continuance. Any person who shall continue any work in or about the building or structure after having been served with a stop work order, except such work as that person is directed to perform to remove a violation or unsafe condition, shall be liable to a fine of not more than $1,000 or by imprisonment for not more than one year, or both for each such violation. Each day during which a violation exists shall constitute a separate offense.

780 CMR 120.0 CERTIFICATE OF OCCUPANCY

120.1 General. New Buildings and Structures. A building or structure hereafter shall not be used or occupied in whole or in part until the certificate of use and occupancy shall have been issued by the building commissioner or inspector of buildings or, when applicable, the state inspector. The certificate shall not be issued until all the work has been completed in accordance with the provisions of the approved permits and of the applicable codes for which a permit is required, except as provided in 780 CMR 120.3.

120.2 Buildings or Structures Hereafter Altered. A building or structure, in whole or in part, altered to change from one use group to another, to a different use within the same use group, the maximum live load capacity, or the occupancy load capacity shall not be occupied or used until the certificate shall have been issued certifying that the work has been completed in accordance with the provisions of the approved permits and of the applicable codes for which a permit is required. Conformance to all applicable Specialized Codes is a requirement of the issuance of the Certificate of Use and Occupancy, including, when applicable, 310 CMR 7.00, 310 CMR 15.00, 310 CMR 22.00 or 310 CMR 30.00.

120.3 Temporary Occupancy. Upon the request of the holder of a permit, a temporary certificate of occupancy may be issued before the completion of the entire work covered by the permit, provided that such portion or portions shall be occupied safely prior to full completion of the building or structure without endangering life or public welfare. The Building Official may consult with all sub-trade Inspectors for issues pertaining to life safety and shall consult with the Fire Official pertaining to issues of adequacy of fire protection systems prior to the issuance of a Temporary Certificate.

120.4 Contents of Certificate. Upon completion of the final inspection in accordance with 780 CMR 115.5 and correction of the violations and discrepancies, compliance with 780 CMR 901.7.4, and receipt of the documentation when required in 780 CMR 116.2.2, the certificate of occupancy shall be issued. When a building or structure is entitled thereto, the building official shall issue a certificate of occupancy within five business days after written application. The certificate of occupancy shall specify or reference the following.

1. The edition of the code under which the permit was issued.

2. The use group and occupancy, in accordance with the provisions of 780 CMR 3.00.
3. The type of construction as defined in 780 CMR 6.00.
4. The occupant load per floor.
5. Any special stipulations and conditions of the building permit.

120.5 Posting Structures.

120.5.1 Posting of Use and Occupancy. A copy of the Certificate of Occupancy and Use shall be posted at the main entry or be made readily available for inspection.

120.5.2 Required Egress Posting. A suitably designed placard, approved by the building official shall be posted by the owner on all floors of every building and structure, except High Hazard, Factory, and I-3 use occupancies, as defined in 780 CMR 3.00. In addition to the per floor requirement, all rooms used as a place of assembly or as an R-1 sleeping space shall have the required egress posting. Said placard shall be securely fastened to the building or structure in a readily visible place, showing exiting paths per floor.

120.5.3 Place of Assembly Posting. A placard suitably designed in contrasting colors and approved by the building official, shall be posted by the owner in every room where practicable of every building and structure and part thereof designed for use as a place of public assembly (use groups A). Said placard shall designate all of the occupant loads approved for each configuration within each room or space.

120.5.4 Replacement of Posted Signs. All posting signs shall be furnished by the owner and shall be of permanent design; they shall not be removed or defaced, and if lost, removed or defaced, shall be immediately replaced.

120.5.5 Periodic Inspection for Posting. The building official may periodically inspect all existing buildings and structures except one and two family dwellings for compliance with 780 CMR in respect to posting; or he may accept the report of such inspections from a qualified registered engineer or architect or others certified by the BBRS; and such inspections and reports shall specify any violation of the requirements of 780 CMR in respect to the posting requirements of 780 CMR 120.5.2 and 120.5.3.

780 CMR 121.0 UNSAFE STRUCTURES

121.1 General. The provisions of 780 CMR 121.0 are established by M.G.L. c. 143, §§ 6, 7, 8, 9 and 10.

121.2 Inspection. The building official immediately upon being informed by report or otherwise that a building or other structure or anything attached thereto or connected therewith is dangerous to life or limb or that any building in that city or town is unused, uninhabited or abandoned, and open to the weather, shall inspect the same; and he shall forthwith in writing notify the owner to remove it or make it safe if it appears to him to be dangerous, or to make it secure if it is unused, uninhabited or abandoned and open to the weather. If it appears that such building or structure would be especially unsafe in case of fire, it shall be deemed dangerous within the meaning hereof, and the building official may affix in a conspicuous place upon its exterior walls a notice of its dangerous condition, which shall not be removed or defaced without authority from him.

121.3 Removal or Making Structure Safe. Any person so notified shall be allowed until 12:00 P.M. of the day following the service of the notice in which to begin to remove such building or structure or make it safe, or to make it secure, and he shall employ sufficient labor speedily to make it safe or remove it or to make it secure; but if the public safety so requires and if the mayor or selectmen so order, the building official may immediately enter upon the premises with the necessary workmen and assistants and cause such unsafe structure to be made safe or demolished without delay and a proper fence put up for the protection of passersby, or to be made secure.

121.4 Failure to Remove or Make Structure Safe, Survey Board, Survey Report. If an owner of such unsafe structure refuses or neglects to comply with the requirements of such notice within the specified time limit, and such structure is not made safe or taken down as ordered therein, a careful survey of the premises shall be made by a board consisting; in a city, of a city engineer, the head of the fire department, as such term is defined in M.G.L. c. 148, § 1, and one disinterested person to be appointed by the building official; and, in a town of a surveyor, the head of the fire department and one disinterested person to be appointed by the building official. In the absence of any of the above officers or individuals, the mayor or selectmen shall designate one or more officers or other suitable persons in place of the officers so named as members of said board. A written report of such survey shall be made, and a copy thereof served on such owner.

121.5 Removal of Dangerous or Abandoned Structures. If such survey report as outlined in 780 CMR 121.4 declares such structure to be dangerous or to be unused, uninhabited or abandoned, and open to the weather, and if the owner continues such refusal or neglect, the building official shall cause it to be made safe or taken down or to be made secure; and, if the public safety so requires, said building official may at once enter the structure, the land on which it stands or the abutting land or buildings, with such assistance as he may require, and secure the same; and may remove and evict, under the pertinent provisions of M.G.L. c. 239, or otherwise, any tenant or occupant thereof; and may erect such protection for the public by proper fence or otherwise as may be necessary, and for this purpose may close a public highway. In the case of such demolition, the said building official shall cause such lot to be leveled to conform with adjacent grades by a inorganic fill. The costs and charges incurred shall constitute a lien upon the land upon which the structure is located, and shall be enforced in an action of contract; and such owner shall, for every day's continuance of such refusal or neglect after being so notified, be punished by a fine in accordance with 780 CMR 118.4. The provisions of M.G.L. c. 139, § 3A, paragraph two, relative to liens for such debt and the collection of claims for such debt shall apply to any debt referred to in 780 CMR 121.0, except that the said building official shall act hereunder in place of the mayor or board of selectmen. During the time such order is in effect, it shall be unlawful to use or occupy such structure or any portion thereof for any purpose.

121.6 Remedy of Person Ordered to Remove a Dangerous Structure or Make it Safe. Notwithstanding the provisions of 780 CMR 122.0, an owner, aggrieved by such order may have the remedy prescribed by M.G.L. c. 139, § 2: provided that any provision of M.G.L. c. 139, § 2 shall not be construed so as to hinder, delay or prevent the building official from acting and proceeding under 780 CMR 121.0; and provided, further, that 780 CMR 121.0 shall not prevent the city or town from recovering the forfeiture provided in said 780 CMR 121.5 from the date of the service of the original notice, unless the order is annulled by the jury.

121.7 Standards for Making Abandoned Buildings Safe and Secure. When the Building Official deems a building to be abandoned the Building Official shall order the owner pursuant to 780 CMR 121.0 to make said building safe and secure by:

1. Removing all materials determined by the head of the fire department or building official to be dangerous in case of fire.
2. Securing all floors accessible from grade utilizing one of the following methods so long as such method is approved by the head of the fire department and by the building official and confirmed by the issuance of a permit:
   (a) Secure all window and door openings in accordance with the U.S. Fire Administration, National Arson Prevention Initiative Board Up Procedures, continuously until such time as the building is reoccupied; or
   (b) Provide 24 hour watchman services, continuously until such time as the building is reoccupied; or
   (c) Provide a monitored intruder alarm system at the perimeter of all floors accessible from grade, continuously until such time as the building is reoccupied.

Said owner, as the case may be, shall notify the building official in writing that the approved method chosen to secure the building has been completed. Said owner shall allow the building official to enter the building for an inspection to ascertain that the building is secured and made safe. Said owner shall allow the head of the fire department to enter the building. The building official shall be supplied with records of maintenance and operation if the provisions of 780 CMR 121.7.2(b) or (c) are used.

3. Maintain any existing fire protection systems unless written permission is obtained from the head of the fire department in accordance with M.G.L. c. 148, § 27A to shut off or disconnect said fire protection systems.
4. Maintain utilities unless written permission is obtained from the building official to disconnect said utilities. Permission to disconnect utilities shall not be granted if it will result in inadequate heat to prevent freezing of any fire protection system or inadequate utilities to maintain any other protection systems.
5. The requirements of 780 CMR 121.7 1. through 4. do not prevent a building official from ordering or taking expeditious, temporary security measures in emergency situations pending the completion of the requirements of 780 CMR 121.7 1. through 4.

For purposes of 780 CMR 121.7(5), an "emergency situation" shall be defined as: an unexpected incident, which by its very nature may present a threat to public safety.

121.7.1 Refusal or Neglect of Owner to Secure the Abandoned Building. Upon refusal or neglect of said owner to comply with such notice, any building official acting under the authority of 780 CMR 121.3 or 121.5 shall cause to be secured all window and door openings accessible from grade in accordance with 780 CMR 121.7 or other equivalent procedure approved by the head of the fire department, continuously until such time as the building is reoccupied.

121.7.2 Re-occupancy of Abandoned Building. Any building which has been made to conform to the provisions of this regulation during vacancy may be reoccupied under its last permitted use and occupancy classification, provided that any systems which were disconnected or shut down during the period of vacancy are restored to fully functional condition and subject to 780 CMR 111.2 and M.G.L. c. 40A. The local building official shall be notified in writing prior to re-occupancy. If said building is changed in use or occupancy or otherwise renovated or altered, it shall be subject to the applicable provisions of 780 CMR 34.00.

121.8 Marking or Identifying Abandoned Buildings. A building official who determines that a building is abandoned under 780 CMR 121.7, shall notify the head of the fire department about the existence of said building. The building official, in cooperation with the head of the fire department, shall cause said building to be marked in accordance with the marking requirements established by the Board of Fire Prevention Regulations in 527 CMR 10.00: *Fire Protection, General Provisions*.

780 CMR 122.0 BOARD OF APPEALS

122.1 State Building Code Appeals Board. Except for actions taken pursuant to 780 CMR 121.0, whoever is aggrieved by an interpretation, order, requirement, direction or failure to act under 780 CMR by any agency or official of a city, town or region charged with the administration or enforcement of 780 CMR, excepting any specialized codes, may appeal directly to the State Building Code Appeals Board or may appeal first to a local or regional building code appeals board and if aggrieved thereby he may then appeal to the State Building Code Appeals Board as provided in 780 CMR 122.0. In the event an appeal is taken directly to the State Building Code Appeals Board from an interpretation, order, requirement or direction, said appeal shall be filed as specified in 780 CMR 122.3.1 with the State Building Code Appeals Board not later than 45 days after the service of notice thereof of the interpretation, order, requirement or direction.

In the event the appeal is taken directly to the State Building Code Appeals Board for the failure to act, the appeal shall be taken not later than 45 days after a request to act has been made by the aggrieved person in writing and served upon the appropriate building official or chief administrative officer of the state or local agency which fails to act.

If the aggrieved person elects to appeal before the local or regional building code appeals board, he shall not be allowed to enter such appeal with the State Building Code Appeals Board until such time as the said local or regional board renders a decision, unless the reason for appeal to the State Building Code Appeals Board is the failure of the local or regional board to act.

122.2 Membership.

122.2.1 Three Member Panel. The State Building Code Appeals Board (the Board) shall consist of the membership of the BBRS. The chairman of the BBRS shall be Chairman of the Board. The Chairman of the Board may designate any three members of the Board to act as a three member panel to hold any public hearing under 780 CMR 122.0 and to hear testimony and take evidence. The Chairman of the Board shall select one of the three members to act as chairman of the said three member panel. If a three member panel is so designated, the three member panel shall act as the Appeals Board and render a decision as provided in 780 CMR 122.0.

122.2.2 Clerk. The administrator of the BBRS shall designate a clerk to the BBRS. The clerk shall keep a detailed record of all decisions and appeals and a docket book on file showing the name of each appeal properly indexed and the disposition of the appeal. Said docket book shall be open to public inspection at all times during normal business hours.

122.2.3 Quorum. A majority of the Board shall constitute a quorum if the appeal is heard by the entire Board.

122.3 Appeals Procedure for State Building Code Appeals Board.

122.3.1 Entry. Appeals shall be entered on forms provided by the BBRS and shall be accompanied by an entry fee of $150 or such other amounts as may be determined by the BBRS from time to time.

The appeal shall be signed by the appellant or his attorney or agent and shall note the name and address of the person or agency in whose behalf the appeal is taken and the name of the person and address wherein service of notice for the appellant is to be made. The appeal shall also state in detail the interpretation, order, requirement, direction or failure to act which are the grounds of the appeals as well as the particular section or sections of 780 CMR which are involved in the appeal and the reasons for the appellant advances supporting the appeal. The appeal shall disclose any previous appeals granted by any other local or state boards, approved compliance alternatives, or current pending appeals.

A copy of the appeal shall be served in accordance with 780 CMR 118.6 by the appellant on the Building Commissioner/Inspector of Buildings, Head of the Fire Department as well as the person from the state, regional or local agency whose action or inaction causes the appeal to be filed, on or before entry of the appeal. An affidavit, under oath, that such copy has been served shall be filed with the Board forthwith by the appellant.

122.3.2 Stay of Proceedings. Entry of an appeal shall stay all proceedings in furtherance of the action or failure to act appealed from, unless the state, regional or local agency or any person charged with the administration or enforcement of 780 CMR presents evidence and the Board or a three member panel or a single member of the Board, appointed by the chairman for said purpose, finds that upon the evidence presented a stay would involve imminent peril to life or property. In such an event, stay of all proceedings shall be waived or the Board or three member panel or single member may order such other action necessary to preserve public safety.

Before waiving the stay or proceedings, the Board or three member panel or single member of the Board, appointed by the chairman for said purpose, shall hold a hearing and give the appellant and state, regional or local agency or any person claiming that a stay would involve imminent peril to life or property, notice in writing of the hearing not less than 24 hours before said hearing.

122.3.3 Documents. Upon entry, the clerk shall request in writing from the state, city, regional or town officer in charge of the matter on appeal, a copy of the record and all other papers and documents relative to the appeal to be transmitted forthwith to the Board. Said state, city, regional or town officer shall upon receipt of the request of the Board transmit forthwith all the papers and documents and a copy of the record relating to the matter on appeal.

122.3.4 Hearings. The chairman of the Board shall fix a convenient time and place for a public hearing. Said hearings shall be held not later than 30 days after the entry of such appeal, unless such time is extended by agreement with the appellant. Any such party may appear in person or by agent or attorney at such hearing. The chairman or clerk shall give notice of the time and place of said hearing to all parties to the hearing and to anyone else requesting notice in writing at least ten days prior thereto. Failure to hold a public hearing within 30 days shall not affect the validity of the appeal or any decision rendered. The Board or three member panel in its hearings conducted under 780 CMR 122.0 shall not be bound by strict rules of evidence prevailing in courts of law or equity.

122.3.5 Conduct of Hearing. Hearing shall be conducted in accordance with the informal/fair hearing rules as set forth in 801 CMR 1.02.

122.4 Decisions.

122.4.1 Votes Required. If the appeal is conducted by a three member panel, then the concurrence of two of the three members holding the public hearing shall be required. If the appeal is conducted by the entire Board, then a majority vote of those hearing the case shall be required.

122.4.2 Standard. The Board or a three member panel may vary the application of any provision of 780 CMR in any particular case, may determine the suitability of alternate materials and methods of construction, and provide reasonable interpretations of the provisions of 780 CMR; provided that the Board or a three-member panel finds that the decision to grant a variance shall not conflict with the general objectives set forth M.G.L. c. 143, § 95 or with the general objectives of 780 CMR.

122.4.3 Time for Decision. The Board shall within 30 days after such hearing, unless such time is extended by agreement of the parties, issue a decision or order reversing, affirming or modifying in whole or in part the order, interpretation, requirement, direction or failure to act which is the subject matter of the appeal.

Failure to render a decision within 30 days shall not affect the validity of any such decision or appeal.

Notice of and a copy of the decision shall be sent by the clerk to all parties to the appeal and anyone requesting in writing a copy of the decision.

122.4.4 Contents of Decision. All decisions shall be in writing and state findings of fact, conclusions and reasons for decisions. Every decision shall indicate thereon the vote of each member and shall be signed by each member voting. A decision shall not be considered by any person or agency as a precedent for future decisions except as provided in 780 CMR 903.2.1.

122.4.5 Additional Powers. The Board or a three member panel may impose in any decision, limitations both as to time and use, and a continuation of any use permitted may be conditioned upon compliance with future amendments to 780 CMR.

122.5 Enforcement. Upon receipt of the decision of the Board or a three member panel, the parties to the appeal shall take action forthwith to comply with the decision unless a later time is specified in the decision.

122.6 Appeals from State Building Code Appeals Board. Any person aggrieved by a decision of the State Building Code Appeals Board may appeal to a court of law or equity in conformance with M.G.L. c. 30A, § 14.

122.7 Local and Regional Board of Appeals.

122.7.1 Local or Regional Board of Appeals. Except for actions taken pursuant to 780 CMR 121.0, whoever is aggrieved by an interpretation, order, requirement, direction or failure to act under 780 CMR by any agency or official of the city, town or region charged with the administration or enforcement of 780 CMR or any of its rules or regulations, excepting any specialized codes, may appeal first to the appeals board in that city, region or town or to the State Building Code Appeals Board as provided in 780 CMR 122.0.

In the event an appeal is taken from an interpretation, order, requirement or direction, said appeal shall be filed with the local or regional appeals board not later than 45 days after the service of notice thereof of the interpretation, order, requirement or direction.

In the event the appeal is taken for the failure to act, the appeal shall be taken not later than 45 days after a request to act has been made by the aggrieved person in writing and served to the appropriate building official or chief administrative officer of the city, regional or town agency which fails to act.

122.7.2 Membership. Any building code board of appeals duly established by ordinance or by law or otherwise in a city, region or town and in existence on January 1, 1975, shall qualify as a local board of appeals under 780 CMR 122.0 notwithstanding anything to the contrary contained herein. However, the procedure and rights for appeals for such board of appeals shall be governed by 780 CMR.

If a city, region or town had not duly established by ordinance or bylaw or otherwise a local or regional building code appeals board prior to January 1, 1975, said city, region or town may establish a local or regional board of appeals, referred to as the local board of appeals, consisting of five members appointed by the chief administrative officer of the city, region or town: one member appointed for five years, one for four years, one for three years, one for two years and one to serve for one year; and thereafter each new member to serve for five years or until his successor has been appointed.

122.7.3 Qualifications of Local Board Members. Each member of a local board of appeals established under 780 CMR 122.7.2 shall have had at least five years experience in the construction, alteration, repair and maintenance of building and building codes. At least one member shall be a registered structural or civil professional engineer and one member a licensed registered architect.

122.7.4 Chairman of Local or Regional Board. The board shall select one of its members to serve as chairman and a detailed record of all proceedings shall be kept on file in the building department.

122.7.5 Absence of Members. During the absence of a member of a local board of appeals for reason of disability or disqualification, the chief administrative officer of the city, region or town shall designate a substitute who shall meet the qualifications as outlined in 780 CMR 122.7.3.

122.7.6 Quorum. A quorum shall be three members.

122.7.7 Procedures. Entry of appeals shall be governed by 780 CMR 122.3.1 excepting that a city, region or town may set its own entry fee.

Upon notice of entry of appeal the local building commissioner or inspector of buildings shall transmit a copy of the record and all the papers and documents to the local board of appeals.

Entry of an appeal shall stay all proceedings in furtherance of the action or failure to act appealed from, unless the building commissioner or inspector of buildings certifies in writing to the local board of appeals that a stay would involve imminent peril to life or property. Notice in writing of such certification by the building commissioner or inspector of buildings shall be given the appellant at least 24 hours prior to the hearing. In such an event a hearing on such stay shall be given first priority and be the first matter heard by the local board of appeals at its next scheduled meeting. The hearing on the appeal shall be held as soon as possible thereafter in accordance with 780 CMR 122.7.8.

The local board of appeals may establish its own rules for procedure not established herein or not inconsistent with 780 CMR or with the general objectives set forth in M.G.L. c. 143, § 95.

122.7.8 Hearings. All hearings shall be public and notice of said hearings shall be advertised in a newspaper of general circulation in the city, region or town in which the appeal is taken at least ten days before said hearing. Notice of the hearing, setting forth the date and time of said hearing, shall be mailed by the local board of appeals to all parties and all those who requested notice in writing at least 14 days before said hearing. Said hearings shall be held not later than 30 days after the entry of such appeal, unless such time is extended by agreement with the appellant. 780 CMR 122.0 as it pertains to notice shall not apply to hearings on a stay as provided in 780 CMR 122.7.7.

122.7.9 Decisions of Local Boards. A concurring vote of a majority of all the members present shall be required for any decision. The local board of appeals may vary the application of 780 CMR to any particular case, may consider the suitability of alternate materials and methods of construction and may provide reasonable interpretations of the provisions of 780 CMR; provided that the decision of the local board shall not conflict with the general objectives of 780 CMR or with the general objectives of M.G.L. c. 143, § 95. The local board of appeals may impose, in any decision, limitations both as to time and use, and a continuation of any use permitted may be conditioned upon compliance with future amendments to 780 CMR.

122.7.10 Time for Decision. The board shall within 30 days after such hearing, unless such time is extended by agreement of the parties, issue a decision or order reversing, affirming or modifying in whole or in part the order, interpretation, requirement, direction or failure to act which is the subject matter of the appeal.

Failure to render a decision within 30 days shall not affect the validity of any such decision or appeal.

Notice of and a copy of the decision shall be sent by the clerk to all parties to the appeal and to anyone requesting in writing a copy of the decision.

122.7.11 Contents of Decision. All decisions shall be in writing and state findings of fact, conclusions and reasons for the decisions. Every decision shall indicate thereon the vote of each member and shall be signed by each member voting. Any decision shall not be considered by any person or agency as a precedent for future decisions.

122.7.12 Copy of Decision. A copy of any decision by a local board of appeals shall be transmitted to the State Building Code Appeals Board within ten days after the rendering of such decision. If the State Building Code Appeals Board disapproves of the said decision of the local board, it may on its own motion appeal from the decision of the local board of appeals according to 780 CMR 122.0 and call for a hearing *de novo*.

If the State Building Code Appeals Board does not notify the local board in writing within 45 days from the date of the local board's decision, the said decision shall be deemed approved; provided that the decision shall not conflict with the general objectives of the state building code and the objectives of M.G.L. c. 143, § 95.

122.7.13 Enforcement of Decision. If said decision is approved by the State Building Code Appeals Board, all parties to the appeal shall take immediate action in accordance with the decision of the local board unless the person aggrieved by such decision appeals to the State Building Code Appeals Board as provided in 780 CMR 122.0.

122.7.14 Review. Any person, including the State Building Code Appeals Board, aggrieved by a decision of the local board of appeals, whether or not a previous party to the decision, or any municipal officer or official board of the municipality, may, not later than 45 days after the mailing of the decision of the local board, apply to the State Building Code Appeals Board for a hearing *de novo* before the State Board, in accordance with 780 CMR 122.0.

780 CMR 123.0 CONSTRUCTION MATERIALS SAFETY BOARD

123.1 Membership. There shall be a board under the control of the BBRS called the Construction Materials Safety Board (CMSB) which shall consist of 11 members, one of whom shall be a member of the BBRS who shall be *ex-officio* and a voting member of the Board and ten members to be appointed by the chairman of the BBRS: one of whom shall be a member of the Board of Fire Prevention Regulations (BFPR) and who shall be ex-officio and a voting member of the Board; one of whom shall be a municipal building inspector; one of whom shall be a registered professional engineer who is a structural engineer; one of whom shall be a registered architect; one of whom shall be a representative of a commercial testing laboratory; one of whom shall be a representative of a public testing laboratory; two of whom shall be representatives from the construction industry; one of whom shall be a member of a university faculty engaged in research and teaching in structural materials; and one of whom shall be a member of a university faculty engaged in research and teaching in the area of theoretical and applied mechanics.

123.2 Duties. The CMSB will review applications for registration or licensing of individuals, laboratories or firms responsible for the inspection, control and testing of construction materials, and review applications and pertinent data relevant to all materials, devices, products and methods of construction not included in 780 CMR; and report to the BBRS their recommendations. The CMSB will collect information and review cases where disciplinary action against an existing license, whether an individual, laboratory or firm, has been proposed; and make recommendations to the BBRS. The BBRS will issue applications, receive payment for the review of such applications and approvals, registration and licensing fees, and maintain records for the efficient dispatch of the duties of the CMSB.

123.3 Testing and Evaluation Groups. The BBRS shall establish and maintain testing and evaluation groups who will have the responsibility of administering and directing, under the supervision of the BBRS, the testing and controls for evaluating individual applicants, laboratories and firms wishing to become registered or licensed.

780 CMR 124.0 FIRE PREVENTION - FIRE PROTECTION ADVISORY COMMITTEE

124.1 Constitution of the Fire Prevention - Fire Protection Advisory Committee. There shall be a Committee under the control of the BBRS called the Fire Prevention - Fire Protection Advisory Committee, (FPFP Advisory Committee) which shall consist of 17 members, two of whom shall be members of the BBRS; one of whom shall be the State Fire Marshal or his designee; one of whom shall be the Commissioner of the City of Boston Fire Department or his designee; all four of whom shall be *ex-officio* and voting members of the Committee, and 12 members to be appointed by the chairman of the BBRS for a term of one year; two of whom shall be representatives of the Fire Chiefs Association of Massachusetts; two of whom shall be representatives of the Fire Prevention Association of Massachusetts; one of whom shall be a representative of the International Municipal Signalmen's Association;

one of whom shall be a member of the State Board of Fire Prevention Regulations; one of whom shall be a member of the Board of State Examiners of Electricians who satisfies the requirements of that Board as a systems contractor holding a certificate C license and is actively engaged in the business of fire warning systems; one of whom shall be a Massachusetts building official; one of whom shall be a Massachusetts registered Fire Protection Engineer; one of whom shall be a Massachusetts registered professional engineer or architect; one of whom shall be a Massachusetts registered professional engineer with specific experience in the design and installation of smoke control systems. and; one of whom shall be a sprinkler system installer who shall be certified by the National Institute for Certification in Engineering Technologies (NICET), and; one of whom shall be a member proposed jointly by the Massachusetts Burglar and Fire Alarm Association and the Automatic Fire Alarm Association and the Automatic Fire Alarm Association, New England.

The FPFP Advisory Committee shall elect a chairman and a vice chairman and each shall serve for a term one year. A member of an agency or board of the state shall not be eligible for the office of chairman or vice chairman.

124.2 Purpose. The FPFP Advisory Committee shall review and recommend to the BBRS changes to 780 CMR relating to fire prevention and fire protection and more specifically those matters contained in 780 CMR 9.00.

780 CMR 125.0 STRUCTURAL PEER REVIEW ADVISORY COMMITTEE

125.1 Membership. There shall be a Board under the control of the BBRS called the Structural Peer Review Advisory Committee, which shall consist of seven members, six of whom shall be professional engineers, registered in Massachusetts, each having a minimum of ten years of structural design experience and shall be appointed by the BBRS from nominations submitted by the Boston Association of Structural Engineers, the Boston Society of Civil Engineers and the American Consulting Engineers Council of New England. The seventh member shall be the structural engineer member of the BBRS who shall serve as chairman of the Structural Peer Review Advisory Committee.

125.2 Quorum. The chairman of the Structural Peer Review Advisory Committee shall appoint three of the members to mediate the disputes by a majority vote of the three members.

125.3 Purpose. The Structural Peer Review Advisory Committee shall mediate any unresolved disputes between the engineer of record and the reviewing engineer which may result from the independent structural engineer review specified in 780 CMR 110.11.

125.4 Procedure. The structural engineer of record or the reviewing engineer or the owner or the building official shall submit any unresolved disputes cited in Appendix 120.U-5 (3), to the Structural Peer Review Advisory Committee on a form provided for this purpose. The Committee shall convene a mediation hearing within 30 days from the receipt of the application and render a decision in writing within 30 days following the mediation hearing.

780 CMR 2.00

DEFINITIONS

780 CMR 201.0 GENERAL

201.1 Scope. Unless otherwise expressly stated, the following words and terms shall, for the purposes of 780 CMR, have the meanings shown in 780 CMR 2.00.

201.2 Interchangeability. Words used in the present tense include the future; words stated in the masculine gender include the feminine and neuter; the singular number includes the plural and the plural, the singular.

201.3 Terms Defined in Other Codes. *Where terms are not defined in 780 CMR and are defined in the International Mechanical Code or any of the applicable Specialized Codes (see 780CMR 101.5), such terms shall have the meanings ascribed to them as in those codes.*

201.4 Terms Not Defined. Where terms are not defined through the methods authorized by this section, such terms shall have ordinarily accepted meanings such as the context implies.

780 CMR 202.0 DEFINITIONS

ACCESSIBLE. See 521 CMR 5.00.

ACCESSIBLE MEANS OF EGRESS. *See* 780 CMR 1002.1.

ACCESSIBLE ROUTE. *See 521 CMR 5.00.*

ACCREDITATION BODY. *See* 780 CMR 2302.1.

ADDITION. An extension or increase in floor area or height of a building or structure.

ADHERED MASONRY VENEER. *See* 780 CMR 1402.1.

AEROSOL. *See* 780 CMR 307.2.
Level 1 Aerosol Products. *See* 780 CMR 307.2.
Level 2 Aerosol Products. *See* 780 CMR 307.2.
Level 3 Aerosol Products. *See* 780 CMR 307.2.

AEROSOL CONTAINER. *See* 780 CMR 307.2.

AGRICULTURAL, BUILDING. A structure designed and constructed to house farm implements, hay, grain, poultry, livestock or other horticultural products. This structure shall not be a place of human habitation or a place of employment where agricultural products are processed, treated or packaged, nor shall it be a place used by the public.

AIR-INFLATED STRUCTURE. *See* 780 CMR 3102.2.

AIR-SUPPORTED STRUCTURE. *See* 780 CMR 3102.2.
Double Skin. *See* 780 CMR 3102.2.
Single Skin. *See* 780 CMR 3102.2.

AISLE ACCESSWAY. *See* 780 CMR 1002 1.

ALARM NOTIFICATION APPLIANCE. *See* 780 CMR 902.1.

ALARM SIGNAL. *See* 780 CMR 902.1.

ALARM VERIFICATION FEATURE. *See* 780 CMR 902.1.

ALLEY. *See* "Public Way."

ALLOWABLE STRESS DESIGN. *See* 780 CMR 1602.1.

ALTERATION. Any Construction or Renovation to an Existing Structure Other than Repair or Addition.

ALTERNATING TREAD DEVICE. *See* 780 CMR 1002.1.

ANCHOR BUILDING. *See* 780 CMR 402.2.

ANCHORED MASONRY VENEER. *See* 780 CMR 1402.1.

ANNULAR SPACE. *See* 780 CMR 702.1.

ANNUNCIATOR. *See* 780 CMR 902.1.

APPROVED. Acceptable to the Building Official.

APPROVED SOURCE. An independent person, firm or corporation, approved by the building official, who is competent and experienced in the application of engineering principles to materials, methods or systems analyses.

ARCHITECTURAL TERRA COTTA. *See* 780 CMR 2102.1.

AREA, BUILDING. *See* 780 CMR 502.1.

AREA OF REFUGE. *See* 780 CMR 1002.1.

AREAWAY. A subsurface space adjacent to a building open at the top or protected at the top by a grating or guard.

ATRIUM. *See* 780 CMR 404.1.1.

ATTIC. The space between the ceiling beams of the top story and the roof rafters.

AUDIBLE ALARM NOTIFICATION APPLIANCE. *See* 780 CMR 902.1.

AUTOMATIC. *See* 780 CMR 902.1.

AUTOMATIC FIRE-EXTINGUISHING SYSTEM. *See* 780 CMR 902.1.

AUTOMATIC SPRINKLER SYSTEM. *See* 780 CMR 902.1.

AVERAGE AMBIENT SOUND LEVEL. *See* 780 CMR 902.1

AWNING. An architectural projection that provides weather protection, identity or decoration and is wholly supported by the building to which it is attached. An awning is comprised of a lightweight, rigid skeleton structure over which a covering is attached.

BACKING. *See* 780 CMR 1402.1.

BALCONY, EXTERIOR. *See* 780 CMR 1602.1.

BARRICADE. *See* 780 CMR 307.2.
  Artificial Barricade. *See* 780 CMR 307.2.
  Natural Barricade. *See* 780 CMR 307.2.

BASEMENT. That portion of a building that is partly or completely below grade (*See* "Story above grade plane" and 780 CMR 502.1 and 1612.2).

BLEACHERS. *See* 780 CMR 1002.1.

BOARDING HOUSE. *See* 780 CMR 310.2.

BOILING POINT. *See* 780 CMR 307.2.

BOND BEAM. *See* 780 CMR 2102.1.

BRICK. *See* 780 CMR 2102.1.
  Calcium Silicate (Sand Lime Brick). *See* 780 CMR 2102.1.
  Clay or Shale. *See* 780 CMR 2102.1.
  Concrete. *See* 780 CMR 2102.1.

BUILDING. Any structure used or intended for supporting or sheltering any use or occupancy.

BUILDING LINE. The line established by law, beyond which a building shall not extend, except as specifically provided by law.

BUILDING OFFICIAL. The officer or other designated authority charged with the administration and enforcement of 780 CMR, or a duly authorized representative.

BUILT-UP ROOF COVERING. *See* 780 CMR 1502.1.

BUTTRESS. *See* 780 CMR 2102.1.

CABLE-RESTRAINED, AIR-SUPPORTED STRUCTURE. *See* 780 CMR 3102.2.

CANOPY. An architectural projection that provides weather protection, identity or decoration and is supported by the building to which it is attached and at the outer end by not less than one stanchion. A canopy is comprised of a rigid structure over which a covering is attached.

CARBON DIOXIDE EXTINGUISHING SYSTEMS. *See* 780 CMR 902.1.

CAST STONE. *See* 780 CMR 2102.1.

CEILING LIMIT. *See* 780 CMR 902.1.

CEILING RADIATION DAMPER. *See* 780 CMR 702.1.

CELL. *See* 780 CMR 2102.1.

CEMENT PLASTER. *See* 780 CMR 2502.1.

CERAMIC FIBER BLANKET. *See* 780 CMR 721.1.1.

CHIMNEY. *See* 780 CMR 2102.1.

CHIMNEY TYPES. *See* 780 CMR 2102.1.
  High-heat Appliance Type. *See* 780 CMR 2102.1.
  Low-heat Appliance Type. *See* 780 CMR 2102.1.
  Masonry Type. *See* 780 CMR 2102.1.
  Medium-heat Appliance Type. *See* 780 CMR 2102.1.

CLEAN AGENT. *See* 780 CMR 902.1.

CLEANOUT. *See* 780 CMR 2102.1.

CLOSED SYSTEM. *See* 780 CMR 307.2.

COLLECTOR. *See* 780 CMR 2302.1.

COMBINATION FIRE/SMOKE DAMPER. *See* 780 CMR 702.1.

COMBUSTIBLE DUST. *See* 780 CMR 307.2.

COMBUSTIBLE FIBERS. *See* 780 CMR 307.2.

COMBUSTIBLE LIQUID. *See* 780 CMR 307.2.
  Class II. *See* 780 CMR 307.2.
  Class IIIA. *See* 780 CMR 307.2.
  Class IIIB. *See* 780 CMR 307.2.

COMMON PATH OF EGRESS TRAVEL. *See* 780 CMR 1002.1.

COMPRESSED GAS. *See* 780 CMR 307.2.

CONCRETE CARBONATE AGGREGATE. *See* 780 CMR 721.1.1.

CONCRETE, CELLULAR. *See* 780 CMR 721.1.1.

CONCRETE, LIGHTWEIGHT AGGREGATE. *See* 780 CMR 721.1.1.

CONCRETE, PERLITE. *See* 780 CMR 721.1.1.

CONCRETE, SAND-LIGHTWEIGHT. *See* 780 CMR 721.1.1.

CONCRETE, SILICEOUS AGGREGATE. *See* 780 CMR 721.1.1.

CONCRETE, VERMICULITE. *See* 780 CMR 721.1.1.

CONSTRUCTION DOCUMENTS. Written, graphic and pictorial documents prepared or assembled for describing the design, location and physical characteristics of the elements of a project necessary for obtaining a building permit.

CONSTRUCTION TYPES. *See* 780 CMR 602.
  Type I. *See* 780 CMR 602.2.
  Type II. *See* 780 CMR 602.2.
  Type III. *See* 780 CMR 602.3.
  Type IV. *See* 780 CMR 602.4.
  Type V. *See* 780 CMR 602.5.

CONTINUOUS GAS-DETECTION SYSTEM. *See* 780 CMR 415.2.

CONTRACTION JOINT. *See* 780 CMR 1902.1.

CONTROL AREA. *See* 780 CMR 307.2.

CONTROLLED LOW-STRENGTH MATERIAL. A self-compacted, cementitious material used primarily as a backfill in place of compacted fill.

CONVENTIONAL LIGHT-FRAME WOOD CONSTRUCTION. *See* 780 CMR 2302.1.

CORRIDOR. *See* 780 CMR 1002.1.

CORROSION RESISTANCE. The ability of a material to withstand deterioration of its surface or its properties when exposed to its environment.

CORROSIVE. *See* 780 CMR 307.2.

COURT. An Open, Uncovered Space, Unobstructed to the Sky, Bounded on Three or More Sides by Exterior Building Walls or Other Enclosing Devices.

COVER. *See* 780 CMR 2102.1.

COVERED MALL BUILDING. *See* 780 CMR 402.2.

CRIPPLE WALL. *See* 780 CMR 2302.1.

CRYOGENIC FLUID. *See* 780 CMR 307.2.

DALLE GLASS. *See* 780 CMR 2402.1.

DAMPER. *See* 780 CMR 702.1.

DEAD LOADS. *See* 780 CMR 1602.1.

DECK. *See* 780 CMR 1602.1.

DECORATIVE GLASS. *See* 780 CMR 2402.1.

DEFLAGRATION. *See* 780 CMR 307.2.

DELUGE SYSTEM. *See* 780 CMR 902.1.

DESIGN STRENGTH. *See* 780 CMR 1602.1.

DETACHED BUILDING. *See* 780 CMR 307.2.

DETECTOR, HEAT. *See* 780 CMR 902.1.

DETONATION. *See* 780 CMR 307.2.

DIAPHRAGM, UNBLOCKED. *See* 780 CMR 2302.1.

DISPENSING. *See* 780 CMR 307.2.

DOOR, BALANCED. *See* 780 CMR 1002.1.

DORMITORY. *See* 780 CMR 310.2.

DRAFTSTOP. *See* 780 CMR 702.1.

DRAG STRUT. *See* 780 CMR 2302.1.

DRY-CHEMICAL EXTINGUISHING AGENT. *See* 780 CMR 902.1.

DURATION OF LOAD. *See* 780 CMR 1602.1.

DWELLING. A building that contains one or two dwelling units used, intended or designed to be used, rented, leased, let or hired out to be occupied for living purposes.

DWELLING UNIT. *See* 780 CMR 310.2.

EGRESS COURT. *See* 780 CMR 1002.1.

EMERGENCY ALARM SYSTEM. *See* 780 CMR 902.1.

EMERGENCY CONTROL STATION. *See* 780 CMR 415.2.

EMERGENCY ESCAPE AND RESCUE OPENING. *See* 780 CMR 1002.1.

EMERGENCY VOICE/ALARM COMMUNICATIONS. *See* 780 CMR 902.1.

EQUIPMENT SUPPORT. *See* 780 CMR 1602.1.

ESSENTIAL FACILITIES. *See* 780 CMR 1602.1.

EXHAUSTED ENCLOSURE. *See* 780 CMR 415.2.

EXISTING STRUCTURE. A structure erected prior to the date of adoption of the appropriate code, or one for which a legal building permit has been issued.

EXIT. *See* 780 CMR 1002.1.

EXIT ACCESS. *See* 780 CMR 1002.1.

EXIT DISCHARGE. *See* 780 CMR 1002.1.

EXIT DISCHARGE, LEVEL OF. *See* 780 CMR 1002.1.

EXIT ENCLOSURE. *See* 780 CMR 1002.1.

EXIT PASSAGEWAY. *See* 780 CMR 1002.1.

EXPANDED VINYL WALL COVERING. *See* 780 CMR 802.1.

EXPLOSION. *See* 780 CMR 902.1.

EXPLOSIVE. *See* 780 CMR 307.2.
  High Explosive. *See* 780 CMR 307.2.
  Low Explosive. *See* 780 CMR 307.2.
  Mass Detonating Explosives. *See* 780 CMR 307.2.

UN/DOTn CLASS 1 EXPLOSIVES. *See* 780 CMR 307.2.
  Division 1.1. *See* 780 CMR 307.2.
  Division 1.2. *See* 780 CMR 307.2.
  Division 1.3. *See* 780 CMR 307.2.
  Division 1.4. *See* 780 CMR 307.2.
  Division 1.5. *See* 780 CMR 307.2.
  Division 1.6. *See* 780 CMR 307.2.

EXTERIOR SURFACES. *See* 780 CMR 2502.1.

EXTERIOR WALL. *See* 780 CMR 1402.1.

EXTERIOR WALL COVERING. *See* 780 CMR 1402.1.

EXTERIOR WALL ENVELOPE. *See* 780 CMR 1402.1.

F RATING. *See* 780 CMR 702.1.

FABRICATION AREA. *See* 780 CMR 415.2.

FACTORED LOAD. *See* 780 CMR 1602.1.

FIBERBOARD. *See* 780 CMR 2302.1.

FIRE ALARM CONTROL UNIT. *See* 780 CMR 902.1.

FIRE ALARM SIGNAL. *See* 780 CMR 902.1.

FIRE ALARM SYSTEM. *See* 780 CMR 902.1.

FIRE AREA. *See* 780 CMR 702.1.

FIRE BARRIER. *See* 780 CMR 702.1.

FIRE COMMAND CENTER. *See* 780 CMR 902.1.

FIRE DAMPER. *See* 780 CMR 702.1.

FIRE DETECTOR, AUTOMATIC. *See* 780 CMR 902.1.

FIRE DOOR. *See* 780 CMR 702.1.

FIRE DOOR ASSEMBLY. *See* 780 CMR 702.1.

FIRE EXIT HARDWARE. *See* 780 CMR 1002.1.

FIRE PARTITION. *See* 780 CMR 702.1.

FIRE PROTECTION RATING. *See* 780 CMR 702.1.

FIRE PROTECTION SYSTEM. *See* 780 CMR 902.1.

FIRE RESISTANCE. *See* 780 CMR 702.1.

FIRE-RESISTANCE RATING. *See* 780 CMR 702.1.

FIRE-RESISTANT JOINT SYSTEM. *See* 780 CMR 702.1.

FIRE SAFETY FUNCTIONS. *See* 780 CMR 902.1.

FIRE SEPARATION DISTANCE. *See* 780 CMR 702.1.

FIRE WALL. *See* 780 CMR 702.1.

FIRE WINDOW ASSEMBLY. *See* 780 CMR 702.1.

FIREBLOCKING. *See* 780 CMR 702.1.

FIREPLACE. *See* 780 CMR 2102.1.

FIREPLACE THROAT. *See* 780 CMR 2102.1.

FIREWORKS. See 780 CMR 307.2.

FIREWORKS, 1.3g. See 780 CMR 307.2..

FIREWORKS, 1.4g. See 780 CMR 307.2.

5% FRACTILE. *See* 780 CMR 1913.2.2.

FLAME RESISTANCE. *See* 780 CMR 802.1.

FLAME SPREAD. *See* 780 CMR 802.1.

FLAME SPREAD INDEX. *See* 780 CMR 802.1.

FLAMMABLE GAS. *See* 780 CMR 307.2.

FLAMMABLE LIQUEFIED GAS. *See* 780 CMR 307.2.

FLAMMABLE LIQUID. *See* 780 CMR 307.2.
  Class IA. *See* 780 CMR 307.2.
  Class IB. *See* 780 CMR 307.2.
  Class IC. *See* 780 CMR 307.2.

FLAMMABLE MATERIAL. *See* 780 CMR 307.2.

FLAMMABLE SOLID. *See* 780 CMR 307.2.

FLAMMABLE VAPORS OR FUMES. *See* 780 CMR 415.2.

FLASH POINT. *See* 780 CMR 307.2.

FLEXIBLE EQUIPMENT CONNECTIONS. *See* 780 CMR 1602.1.

FLOOR AREA, GROSS. *See* 780 CMR 1002.1.

FLOOR AREA, NET. *See* 780 CMR 1002.1.

FLOOR FIRE DOOR ASSEMBLY. *See* 780 CMR 702.1.

FLY GALLERY. *See* 780 CMR 410.2.

FOAM-EXTINGUISHING SYSTEMS. *See* 780 CMR 902.1.

FOAM PLASTIC INSULATION. *See* 780 CMR 2602.1.

FOLDING AND TELESCOPIC SEATING. *See* 780 CMR 1002.1.

FOOD COURT. *See* 780 CMR 402.2.

GAS CABINET. *See* 780 CMR 415.2.

GAS ROOM. *See* 780 CMR 415.2.

GLASS FIBERBOARD. *See* 780 CMR 721.1.1.

GLUED BUILT-UP MEMBER. *See* 780 CMR 2302.1.

GRADE FLOOR OPENING. A window or other opening located such that the sill height of the opening is not more than 44 inches (1118 mm) above or below the finished ground level adjacent to the opening.

GRADE (LUMBER). *See* 780 CMR 2302.1.

GRADE PLANE. *See* 780 CMR 502.1.

GRANDSTAND. *See* 780 CMR 1002.1.

GRIDIRON. *See* 780 CMR 410.2.

GROSS LEASABLE AREA. *See* 780 CMR 402.2.

GROUTED MASONRY. *See* 780 CMR 2102.1.
Grouted hollow-unit Masonry. *See* 780 CMR 2102.1.
Grouted Multiwythe Masonry. *See* 780 CMR 2102.1.

GUARD. *See* 780 CMR 1002.1.

GYPSUM BOARD. *See* 780 CMR 2502.1.

GYPSUM PLASTER. *See* 780 CMR 2502.1.

GYPSUM VENEER PLASTER. *See* 780 CMR 2502.1.

HABITABLE SPACE. A space in a building for living, sleeping, eating or cooking. Bathrooms, toilet rooms, closets, halls, storage or utility spaces and similar areas are not considered habitable spaces.

HALOGENATED EXTINGUISHING SYSTEMS. *See* 780 CMR 902.1.

HANDLING. *See* 780 CMR 307.2.

HANDRAIL. *See* 780 CMR 1002.1.

HARDBOARD. *See* 780 CMR 2302.1.

HAZARDOUS MATERIALS. *See* 780 CMR 307.2.

HAZARDOUS PRODUCTION MATERIAL (HPM). *See* 780 CMR 415.2.

HEALTH HAZARD. *See* 780 CMR 307.2.

HEIGHT, BUILDING. *See* 780 CMR 502.1.

HEIGHT, STORY. *See* 780 CMR 502.1.

HEIGHT, WALLS. *See* 780 CMR 2102.1.

HELIPORT. *See* 780 CMR 412.5.2.

HELISTOP. *See* 780 CMR 412.5.2.

HIGHLY TOXIC. *See* 780 CMR 307.2.

Historic Buildings. See 780 CMR 3409

HPM FLAMMABLE LIQUID. *See* 780 CMR 415.2.

HPM ROOM. *See* 780 CMR 415.2.

IMMEDIATELY DANGEROUS TO LIFE AND HEALTH (IDLH). *See* 780 CMR 415.2.

IMPACT LOAD. *See* 780 CMR 1602.1.

INCOMPATIBLE MATERIALS. *See* 780 CMR 307.2.

INDUSTRIAL EQUIPMENT PLATFORM. *See* 780 CMR 502.1.

INITIATING DEVICE. *See* 780 CMR 902.1.

INTERIOR FINISH. *See* 780 CMR 802.1.

INTERIOR FLOOR FINISH. *See* 780 CMR 802.1.

INTERIOR SURFACES. *See* 780 CMR 2502.1.

INTERIOR WALL AND CEILING FINISH. *See* 780 CMR 802.1.

INTERLAYMENT. *See* 780 CMR 1502.1.

JOINT. *See* 780 CMR 702.1.

JURISDICTION. The governmental unit that has adopted 780 CMR under due legislative authority.

LIGHT-DIFFUSING SYSTEM. *See* 780 CMR 2602.1.

LIGHT-FRAME CONSTRUCTION. A type of construction whose vertical and horizontal structural elements are primarily formed by a system of repetitive wood or light gage steel framing members.

LIGHT-TRANSMITTING PLASTIC ROOF PANELS. *See* 780 CMR 2602.1.

LIGHT-TRANSMITTING PLASTIC WALL PANELS. *See* 780 CMR 2602.1.

LIQUID. *See* 780 CMR 415.2.

LIQUID STORAGE ROOM. *See* 780 CMR 415.2.

LIQUID USE, DISPENSING AND MIXING ROOMS. *See* 780 CMR 415.2.

LISTED. *See* 780 CMR 902.1.

LIVE LOADS. *See* 780 CMR 1602.1.

LIVE LOADS (ROOF). *See* 780 CMR 1602.1.

LOAD AND RESISTANCE FACTOR DESIGN (LRFD). *See* 780 CMR 1602.1.

LOAD FACTOR. *See* 780 CMR 1602.1.

LOADS. *See* 780 CMR 1602.1.

LOADS EFFECTS. *See* 780 CMR 1602.1.

LOT. A portion or parcel of land considered as a unit.

LOT LINE. A line dividing one lot from another, or from a street or any public place.

LOWER FLAMMABLE LIMIT (LFL). *See* 780 CMR 415.2.

MALL. *See* 780 CMR 402.2.

MANUAL FIRE ALARM BOX. *See* 780 CMR 902.1.

MARQUEE. A permanent roofed structure attached to and supported by the building and that projects into the public right- of-way.

MASONRY. *See* 780 CMR 2102.1.
  Ashlar Masonry. *See* 780 CMR 2102.1.
  Coursed Ashlar. *See* 780 CMR 2102.1.
  Glass Unit Masonry. *See* 780 CMR 2102.1.
  Plain Masonry. *See* 780 CMR 2102.1.
  Random Ashlar. *See* 780 CMR 2102.1.
  Reinforced Masonry. *See* 780 CMR 2102.1.
  Solid Masonry. *See* 780 CMR 2102.1.

MASONRY UNIT. *See* 780 CMR 2102.1.
  Clay. *See* 780 CMR 2102.1.
  Concrete. *See* 780 CMR 2102.1.
  Hollow. *See* 780 CMR 2102.1.
  Solid. *See* 780 CMR 2102.1.

MEAN ROOF HEIGHT. *See* 780 CMR 1609.2.

MEANS OF EGRESS. *See* 780 CMR 1002.1.

MECHANICAL-ACCESS OPEN PARKING GARAGES. *See* 780 CMR 406.3.2.

MECHANICAL EQUIPMENT SCREEN. *See* 780 CMR 1502.1.

MEMBRANE-COVERED CABLE STRUCTURE. *See* 780 CMR 3102.2.

MEMBRANE-COVERED FRAME STRUCTURE. *See* 780 CMR 3102.2.

MEMBRANE PENETRATION. *See* 780 CMR 702.1.

MEMBRANE-PENETRATION FIRESTOP. *See* 780 CMR 702.1.

METAL COMPOSITE MATERIAL (MCM). *See* 780 CMR 1402.

METAL COMPOSITE MATERIAL SYSTEM. *See* 780 CMR 1402.

METAL ROOF PANEL. *See* 780 CMR 1502.1.

METAL ROOF SHINGLE. *See* 780 CMR 1502.1.

MEZZANINE. *See* 780 CMR 502.1.

MINERAL BOARD. *See* 780 CMR 721.1.1.

MODIFIED BITUMEN ROOF COVERING. *See* 780 CMR 1502.1.

MORTAR. *See* 780 CMR 2102.1.

MORTAR, SURFACE-BONDING. *See* 780 CMR 2102.1.

MULTIPLE-STATION ALARM DEVICE. *See* 780 CMR 902.1.

MULTIPLE-STATION SMOKE ALARM. *See* 780 CMR 902.1.

NAILING, BOUNDARY. *See* 780 CMR 2302.1.

NAILING, EDGE. *See* 780 CMR 2302.1.

NAILING, FIELD. *See* 780 CMR 2302.1.

NATURALLY DURABLE WOOD. *See* 780 CMR 2302.1.
  Decay Resistant. *See* 780 CMR 2302.1.
  Termite Resistant. *See* 780 CMR 2302.1.

NOMINAL LOADS. *See* 780 CMR 1602.1.

NOMINAL SIZE (LUMBER). *See* 780 CMR 2302.1.

NONCOMBUSTIBLE MEMBRANE STRUCTURE. *See* 780 CMR 3102.2.

NORMAL TEMPERATURE AND PRESSURE (NTP). *See* 780 CMR 415.2.

NOSING. *See* 780 CMR 1002.1.

NUISANCE ALARM. *See* 780 CMR 902.1.

OCCUPANT LOAD. *See* 780 CMR 1002.1.

OCCUPIABLE SPACE. A room or enclosed space designed for human occupancy in which individuals congregate for amusement, educational or similar purposes or in which occupants are engaged at labor, and which is equipped with means of egress and light and ventilation facilities meeting the requirements of 780 CMR.

OPEN PARKING GARAGE. *See* 780 CMR 406.3.2.

OPEN SYSTEM. *See* 780 CMR 307.2.

OPERATING BUILDING. *See* 780 CMR 307.2.

ORGANIC PEROXIDE. *See* 780 CMR 307.2.
  Class I. *See* 780 CMR 307.2.
  Class II. *See* 780 CMR 307.2.
  Class III. *See* 780 CMR 307.2.
  Class IV. *See* 780 CMR 307.2.
  Class V. *See* 780 CMR 307.2.
  Unclassified Detonable. *See* 780 CMR 307.2.

OWNER. Any person, agent, firm or corporation having a legal or equitable interest in the property.

OXIDIZER. *See* 780 CMR 307.2.
  Class 4. *See* 780 CMR 307.2.
  Class 3. *See* 780 CMR 307.2.
  Class 2. *See* 780 CMR 307.2.
  Class 1. *See* 780 CMR 307.2.

OXIDIZING GAS. *See* 780 CMR 307.2.

P-DELTA EFFECT. *See* 780 CMR 1602.1.

PANEL (PART OF A STRUCTURE). *See* 780 CMR 1602.1.

PANIC HARDWARE. *See* 780 CMR 1002.1.

PARTICLEBOARD. *See* 780 CMR 2302.1.

PEDESTAL. *See* 780 CMR 1902.1.

PENETRATION FIRESTOP. *See* 780 CMR 702.1.

PENTHOUSE. *See* 780 CMR 1502.1.

PERMIT. An official document or certificate issued by the authority having jurisdiction which authorizes performance of a specified activity.

PERSON. An individual, heirs, executors, administrators or assigns, and also includes a firm, partnership or corporation, its or their successors or assigns, or the agent of any of the aforesaid.

PERSONAL CARE SERVICE. *See* 780 CMR 310.2.

PHYSICAL HAZARD. *See* 780 CMR 307.2.

PIER FOUNDATIONS. *See* 780 CMR 1808.1.

PILE FOUNDATIONS. *See* 780 CMR 1808.1.
PINRAIL. *See* 780 CMR 410.2.

PLAIN CONCRETE. *See* 780 CMR 1902.1.

PLASTIC, APPROVED. *See* 780 CMR 2602.1.

PLASTIC GLAZING. *See* 780 CMR 2602.1.

PLASTIC HINGE. *See* 780 CMR 2102.1.

PLATFORM. *See* 780 CMR 410.2.

POSITIVE ROOF DRAINAGE. *See* 780 CMR 1502.1.

PRESERVATIVE-TREATED WOOD. *See* 780 CMR 2302.1.

PRISM. *See* 780 CMR 2102.1.

PROSCENIUM WALL. *See* 780 CMR 410.2.

PUBLIC WAY. *See* 780 CMR 1002.1.

PYROPHORIC. *See* 780 CMR 307.2.

PYROTECHNIC COMPOSITION. *See* 780 CMR 307.2.

QUALITY ASSURANCE PLAN. A written procedure complying with the requirements of 780 CMR 1705.

RAMP. *See* 780 CMR 1002.1.

RAMP-ACCESS OPEN PARKING GARAGES. *See* 780 CMR 406.3.2.

RECORD DRAWINGS. *See* 780 CMR 902.1.

REGISTERED DESIGN PROFESSIONAL. An individual who is registered or licensed to practice their respective design profession as defined by the statutory requirements of the professional registration laws of the state or jurisdiction in which the project is to be constructed.

REINFORCED PLASTIC, GLASS FIBER. *See* 780 CMR 2602.1.

REPAIR. The reconstruction or renewal of any part of an existing building for the purpose of its maintenance.

REROOFING. *See* 780 CMR 1502.1.

RESIDENTIAL AIRCRAFT HANGAR. *See* 780 CMR 412.3.1.

RESIDENTIAL CARE/ASSISTED LIVING FACILITIES. *See* 780 CMR 310.2.

RESISTANCE FACTOR. *See* 780 CMR 1602.1.

ROOF ASSEMBLY. *See* 780 CMR 1502.1.

ROOF COVERING. *See* 780 CMR 1502.1.

ROOF COVERING SYSTEM. *See* 780 CMR 1502.1.

ROOF DECK. *See* 780 CMR 1502.1.

ROOF RECOVER. *See* 780 CMR 1502.1.

ROOF REPAIR. *See* 780 CMR 1502.1.

ROOF REPLACEMENT. *See* 780 CMR 1502.1.

ROOF VENTILATION. *See* 780 CMR 1502.1.

ROOFTOP STRUCTURE. *See* 780 CMR 1502.1.

RUBBLE MASONRY. *See* 780 CMR 2102.1.
- **Coursed Rubble**. *See* 780 CMR 2102.1.
- **Random Rubble**. *See* 780 CMR 2102.1.
- **Rough or Ordinary Rubble**. *See* 780 CMR 2102.1.

RUNNING BOND. *See* 780 CMR 2102.1.

SCISSOR STAIR. *See* 780 CMR 1002.1.

SCUPPER. *See* 780 CMR 1502.1.

SERVICE CORRIDOR. *See* 780 CMR 415.2.

SERVICE ENTRANCE. *See* 780 CMR 1102.1.

SHAFT. *See* 780 CMR 702.1.

SHAFT ENCLOSURE. *See* 780 CMR 702.1.

SHALLOW ANCHORS. *See* 780 CMR 1602.1.

SHEAR PANEL. *See* 780 CMR 1602.1.

SHEAR WALL. *See* 780 CMR 1602.1.

SINGLE-PLY MEMBRANE. *See* 780 CMR 1502.1.

SINGLE-STATION SMOKE ALARM. *See* 780 CMR 902.1.

SKYLIGHT, UNIT. A factory-assembled, glazed fenestration unit, containing one panel of glazing material that allows for natural lighting through an opening in the roof assembly while preserving the weather-resistant barrier of the roof.

SKYLIGHTS AND SLOPED GLAZING. Glass or other transparent or translucent glazing material installed at a slope of 15 degrees (0.26 rad) or more from vertical. Glazing material in skylights, including unit skylights, solariums, sunrooms, roofs and sloped walls, are included in this definition.

SLEEPING UNIT. A room or space in which people sleep, which can also include permanent provisions for living, eating, and either sanitation or kitchen facilities but not both. Such rooms and spaces that are also part of a dwelling unit are not sleeping units.

SMOKE ALARM. *See* 780 CMR 902.1.

SMOKE BARRIER. *See* 780 CMR 702.1.

SMOKE COMPARTMENT. *See* 780 CMR 702.1.

SMOKE DAMPER. *See* 780 CMR 702.1.

SMOKE DETECTOR. *See* 780 CMR 902.1.

SMOKE-DEVELOPED INDEX. *See* 780 CMR 802.1.

SMOKE-PROTECTED ASSEMBLY SEATING. *See* 780 CMR 1002.1.

SMOKEPROOF ENCLOSURE. *See* 780 CMR 902.1.

SOLID. *See* 780 CMR 415.2.

SPECIAL AMUSEMENT BUILDING. *See* 780 CMR 411.2.

SPLICE. *See* 780 CMR 702.1.

SPRAYED FIRE-RESISTANT MATERIALS. *See* 780 CMR 1702.1.

STACK BOND. *See* 780 CMR 2102.1.

STAGE. *See* 780 CMR 410.2.

STAIR. *See* 780 CMR 1002.1.

STAIRWAY. *See* 780 CMR 1002.1.

STAIRWAY, EXTERIOR. *See* 780 CMR 1002.1.

STAIRWAY, INTERIOR. *See* 780 CMR 1002.1.

STAIRWAY, SPIRAL. *See* 780 CMR 1002.1.

STANDPIPE SYSTEM, CLASSES OF. *See* 780 CMR 902.1.
  Class I System. *See* 780 CMR 902.1.
  Class II System. *See* 780 CMR 902.1.
  Class III System. *See* 780 CMR 902.1.

STANDPIPE, TYPES OF. *See* 780 CMR 902.1.
  Automatic Dry. *See* 780 CMR 902.1.
  Automatic Wet. *See* 780 CMR 902.1.
  Manual Dry. *See* 780 CMR 902.1.
  Manual Wet. *See* 780 CMR 902.1.
  Semiautomatic Dry. *See* 780 CMR 902.1.

STEEL CONSTRUCTION, COLD-FORMED. *See* 780 CMR 2202.1.

STEEL JOIST. *See* 780 CMR 2202.1.

STEEL MEMBER, STRUCTURAL. *See* 780 CMR 2202.1.

STEEP SLOPE. A roof slope greater than two units vertical in 12 units horizontal (17-percent slope).

STORAGE, HAZARDOUS MATERIALS. *See* 780 CMR 415.2.

STORY. That portion of a building included between the upper surface of a floor and the upper surface of the floor or roof next above (also *See* "Basement," "Mezzanine" and 780 CMR 502.1). It is measured as the vertical distance from top to top of two successive tiers of beams or finished floor surfaces and, for the topmost story, from the top of the floor finish to the top of the ceiling joists or, where there is not a ceiling, to the top of the roof rafters.

STORY ABOVE GRADE PLANE. Any story having its finished floor surface entirely above grade plane, except that a basement shall be considered as a story above grade plane where the finished surface of the floor above the basement is:

1. More than six feet (1829 mm) above grade plane;
2. More than six feet (1829 mm) above the finished ground level for more than 50% of the total building perimeter; or
3. More than 12 feet (3658 mm) above the finished ground level at any point.

STRENGTH. *See* 780 CMR 2102.1.
  Design Strength. *See* 780 CMR 2102.1.
  Nominal Strength. *See* 780 CMR 1602.1 and 2102.1.

STRENGTH DESIGN. *See* 780 CMR 1602.1.

STRUCTURAL GLUED-LAMINATED TIMBER. *See* 780 CMR 2302.1.

STRUCTURE. That which is built or constructed.

SUBDIAPHRAGM. *See* 780 CMR 2302.1.

SUPERVISING STATION. *See* 780 CMR 902.1.

SUPERVISORY SERVICE. *See* 780 CMR 902.1.

SUPERVISORY SIGNAL. *See* 780 CMR 902.1.

SUPERVISORY SIGNAL-INITIATING DEVICE. *See* 780 CMR 902.1.

T RATING. *See* 780 CMR 702.1.

TENT. Any structure, enclosure or shelter which is constructed of canvas or pliable material supported in any manner except by air or the contents it protects.

THERMOPLASTIC MATERIAL. *See* 780 CMR 2602.1.

THERMOSETTING MATERIAL. *See* 780 CMR 2602.1.

THROUGH PENETRATION. *See* 780 CMR 702.1.

THROUGH-PENETRATION FIRESTOP SYSTEM. *See* 780 CMR 702.1.

TIE-DOWN (HOLD-DOWN). *See* 780 CMR 2302.1.

TILE. *See* 780 CMR 2102.1.

TILE, STRUCTURAL CLAY. *See* 780 CMR 2102.1.

TIRES, BULK STORAGE OF. *See* 780 CMR 902.1.

TOXIC. *See* 780 CMR 307.2.

TREATED WOOD. *See* 780 CMR 2302.1.

TRIM. *See* 780 CMR 802.1.

TROUBLE SIGNAL. *See* 780 CMR 902.1.

UNADJUSTED SHEAR RESISTANCE. *See* 780 CMR 2202.1.

UNDERLAYMENT. *See* 780 CMR 1502.1.

UNSTABLE (REACTIVE) MATERIAL. *See* 780 CMR 307.2.
  Class 4. *See* 780 CMR 307.2.
  Class 3. *See* 780 CMR 307.2.
  Class 2. *See* 780 CMR 307.2.
  Class 1. *See* 780 CMR 307.2.

USE (MATERIAL). *See* 780 CMR 415.2.

VAPOR-PERMEABLE MEMBRANE. A material or covering having a permeance rating of 5 perms (52.9 _10^{-10} kg/Pa - s _ m^2) or greater, when tested in accordance with the dessicant method using Procedure A of ASTM E 96. A vapor-permeable material permits the passage of moisture vapor.

VAPOR RETARDER. A vapor-resistant material, membrane or covering such as foil, plastic sheeting or insulation facing having a permeance rating of 1 perm (5.7 _ 10^{-11} kg/Pa _ s _ m^2) or less, when tested in accordance with the dessicant method using Procedure A of ASTM E 96. Vapor retarders limit the amount of moisture vapor that passes through a material or wall assembly.

VENEER. *See* 780 CMR 1402.1.

VENTILATION. The natural or mechanical process of supplying conditioned or unconditioned air to, or removing such air from, any space.

VISIBLE ALARM NOTIFICATION APPLIANCE. *See* 780 CMR 902.1.

WALKWAY, PEDESTRIAN. A walkway used exclusively as a pedestrian trafficway.

WALL. *See* 780 CMR 2102.1.
  Composite Wall. *See* 780 CMR 2102.1.
  Dry-stacked, Surface-bonded Wall. *See* 780 CMR 2102.1.
  Parapet Wall. *See* 780 CMR 2102.1.

WALL, LOAD-BEARING. *See* 780 CMR 1602.1.

WALL, NONLOAD-BEARING. *See* 780 CMR 1602.1.

WATER-REACTIVE MATERIAL. *See* 780 CMR 307.2.
  Class 3. *See* 780 CMR 307.2.
  Class 2. *See* 780 CMR 307.2.
  Class 1. *See* 780 CMR 307.2.

WEATHER-EXPOSED SURFACES. *See* 780 CMR 2502.1.

WEB. *See* 780 CMR 2102.1.

WET-CHEMICAL EXTINGUISHING SYSTEM. *See* 780 CMR 902.1.

WIRE BACKING. *See* 780 CMR 2502.1.

WIRELESS PROTECTION SYSTEM. *See* 780 CMR 902.1.

WOOD SHEAR PANEL. *See* 780 CMR 2302.1.

WOOD STRUCTURAL PANEL. *See* 780 CMR 2302.1.
  Composite Panels. *See* 780 CMR 2302.1.
  Oriented Strand Board (OSB). *See* 780 CMR 2302.1.
  Plywood. *See* 780 CMR 2302.1.

WORKSTATION. *See* 780 CMR 415.2.

YARD. An open space, other than a court, unobstructed from the ground to the sky, except where specifically provided by 780 CMR, on the lot on which a building is situated.

ZONE. *See* 780 CMR 902.1.

NON-TEXT PAGE

780 CMR 3.00

USE AND OCCUPANCY CLASSIFICATION

780 CMR 301.0 GENERAL

301.1 Scope. The provisions of 780 CMR 3.00 shall control the classification of all buildings and structures as to use and occupancy.

301.1.1 The ICC International Fire Code (IFC), the ICC International Mechanical Code (IMC) and the Specific Specialized Code - The Board of Fire Prevention Regulations (527 CMR). 780 CMR contains design and construction requirements for all USE Group buildings and their building permittable systems and also references additional applicable design and construction requirements of the IFC and the IMC for the various USE Groups and industrial processes within such USE Groups, including H-USES. It is the intention in referencing the IFC and the IMC that only the IFC and IMC requirements narrow to Building Code matters; i.e., USE Group classification, general building limitations of height and area, fireresistant materials and construction, interior finishes, required fire protection systems (otherwise not specifically regulated by 527 CMR), means of egress, interior environment, energy conservation, exterior wall coverings, roof and roof coverings, structural loads, structural tests and inspections, foundations and retaining walls, construction materials, glass and glazing, plastics, mechanical systems, special construction, site work, demolition and construction in the public right-of-way, building permittable work in existing buildings and control of manufactured buildings and manufactured components, etc., as historically addressed in the Massachusetts State Building Code are regulated by 780 CMR.

***Exception**: The design and construction requirements of bunkers and magazines for the storage of explosive materials, flammable/ combustible liquids and chemical process safety, shall default to the specific requirements of 527 CMR and are not enforceable by Building Officials but rather by the Head of the Fire Department or his/her designee.*

Note that the IFC and the IMC are not only building and building permittable systems design and construction documents but also include fire prevention requirements and the fire prevention requirements of the IFC and IMC are not requirements regulated by 780 CMR nor enforceable by Building Officials. For fire prevention requirements do not refer to the IFC or IMC but rather to The Massachusetts Board of Fire Prevention Regulations (527 CMR). If there is conflict between 780 CMR and 527 CMR, the more stringent standard shall apply.

301.1.2 The ICC International Fire Code (IFC), the ICC International Mechanical Code (IMC) and the Family of Massachusetts Specialized Codes (refer to 780 CMR, 101.5). 780 CMR contains design and construction requirements for all USE Group buildings and their building permittable systems and also references additional applicable design and construction requirements of the IFC and the IMC for the various USE Groups and industrial processes within such USE Groups, including H-USES. It is the intention in referencing the IFC and the IMC that only the IFC and IMC requirements narrow to Building Code matters (see 780 CMR 301.1.1) are regulated by 780 CMR. Where the IFC and IMC reference requirements related to: architectural access; environmental protection; electrical; elevator; fire prevention (otherwise not specifically regulated by 527 CMR); gas; or sanitary code requirements, such requirements are not regulated by 780 CMR nor enforceable by Building Officials (Building Officials do enforce architectural access requirements set forth in 521 CMR). For Specialized Code requirements do not refer to the IFC or IMC but rather to the appropriate Specialized Code requirements of Massachusetts (refer to 780 CMR, 101.5).

780 CMR 302.0 CLASSIFICATION

302.1 General. Structures or portions of structures shall be classified with respect to occupancy in one or more of the groups listed below. Structures with multiple uses shall be classified according to 780 CMR 302.3. Where a structure is proposed for a purpose which is not specifically provided for in 780 CMR, such structure shall be classified in the group which the occupancy most nearly resembles, according to the fire safety and relative hazard involved.

1. Assembly (*See* 780 CMR 303.0): Groups A-1, A-2, A-3, A-4 and A-5
2. Business (*See* 780 CMR 304.0): Group B
3. Educational (*See* 780 CMR 305.0): Group E
4. Factory and Industrial (*See* 780 CMR 306.0): Groups F-1 and F-2
5. High Hazard (*See* 780 CMR 307.0): Groups H-1, H-2, H-3, H-4 and H-5
6. Institutional (*See* 780 CMR 308.0): Groups I-1, I-2, I-3 and I-4
7. Mercantile (*See* 780 CMR 309.0): Group M

8. Residential (*See* 780 CMR 310.0): Groups R-1, R-2, R-3 as applicable in 780 CMR 101.2, and R-4
9. Storage (*See* 780 CMR 311.0): Groups S-1 and S-2
10. Utility and Miscellaneous (*See* 780 CMR 312.0): Group U

302.1.1 Incidental Use Areas. Spaces which are incidental to the main occupancy shall be separated or protected, or both, in accordance with Table 302.1.1 or the building shall be classified as a mixed occupancy and comply with 780 CMR 302.3. Areas that are incidental to the main occupancy shall be classified in accordance with the main occupancy of the portion of the building in which the incidental use area is located.

Exception: Incidental use areas within and serving a dwelling unit are not required to comply with 780 CMR 302.0.

302.1.1.1 Separation. Where Table 302.1.1 requires a fire-resistance-rated separation, the incidental use area shall be separated from the remainder of the building with a fire barrier. Where Table 302.1.1 permits an automatic fire-extinguishing system without a fire barrier, the incidental use area shall be separated by construction capable of resisting the passage of smoke. The partitions shall extend from the floor to the underside of the fire-resistance-rated floor/ceiling assembly or fire-resistance-rated roof/ceiling assembly or to the underside of the floor or roof deck above. Doors shall be self-closing or automatic-closing upon detection of smoke. Doors shall not have air transfer openings and shall not be undercut in excess of the clearance permitted in accordance with NFPA 80.

TABLE 302.1.1
INCIDENTAL USE AREAS

ROOM OR AREA	SEPARATION[a]
Furnace room where any piece of equipment is over 400,000 Btu per hour input	1 hour or provide automatic fire-extinguishing system
Rooms with any boiler over 15 psi and 10 horsepower	1 hour or provide automatic fire-extinguishing system
Refrigerant machinery rooms	1 hour or provide automatic sprinkler system
Parking garage (Section 406.2)	2 hours; or 1 hour and provide automatic fire-extinguishing system
Hydrogen cut-off rooms	1-hour fire barriers and floor/ceiling assemblies in Group B, F, H, M, S and U occupancies. 2-hour fire barriers and floor/ceiling assemblies in Group A, E, I and R occupancies.
Incinerator rooms	2 hours and automatic sprinkler system
Paint shops, not classified as Group H, located in occupancies other than Group F	2 hours; or 1 hour and provide automatic fire-extinguishing system
Laboratories and vocational shops, not classified as Group H, located in Group E or I-2 occupancies	1 hour or provide automatic fire-extinguishing system
Laundry rooms over 100 square feet	1 hour or provide automatic fire-extinguishing system
Storage rooms over 100 square feet	1 hour or provide automatic fire-extinguishing system
Group I-3 cells equipped with padded surfaces	1 hour
Group I-2 waste and linen collection rooms	1 hour
Waste and linen collection rooms over 100 square feet	1 hour or provide automatic fire-extinguishing system
Stationary lead-acid battery systems having a liquid capacity of more than 100 gallons used for facility standby power, emergency power or uninterrupted power supplies	1-hour fire barriers and floor/ceiling assemblies in Group B, F, H, M, S and U occupancies. 2-hour fire barriers and floor/ceiling assemblies in Group A, E, I and R occupancies

For SI: 1 square foot = 0.0929 m^2, 1 pound per square inch = 6.9 kPa, 1 British thermal unit per hour = 0.293 watts, 1 horsepower = 746 watts, 1 gallon = 3.785 L.

a. Where an automatic fire-extinguishing system is provided, it need only be provided in the incidental use room or area

302.2 Accessory Use Areas. A fire barrier shall be required to separate accessory use areas classified as Group H in accordance with 780 CMR 302.3.2, and incidental use areas in accordance with 780 CMR 302.1.1. Any other accessory use area shall not be required to be separated by a fire barrier provided the accessory use area occupies an area not more than 10% of the area of the story in which it is located and does not exceed the tabular values in Table 503 for the allowable height or area for such use.

302.2.1 Assembly Areas. Accessory assembly areas are not considered separate occupancies if the floor area is equal to or less than 750 square feet (69.7 m^2). Assembly areas that are accessory to Group E are not considered separate occupancies. Accessory religious educational rooms and religious auditoriums with occupant loads of less than 100 are not considered separate occupancies ***(also See 780 CMR 303.1 and 303.1.1).***

302.3 Mixed Occupancies. Where a building is occupied by two or more uses not included in the same occupancy classification, the building or portion thereof shall comply with 780 CMR 302.3.1 and/or 302.3.2.

Exceptions:

1. Occupancies separated in accordance with 780 CMR 508.0.
2. Areas of Group H-2, H-3, H-4 or H-5 occupancies shall be separated from any other occupancy in accordance with 780 CMR 302.3.2.
3. Where required by Table 415.3.2, areas of Group H-1, H-2 or H-3 occupancy shall be located in a separate and detached building or structure.
4. Accessory use areas in accordance with 780 CMR 302.2.
5. Incidental use areas in accordance with 780 CMR 302.1.1.

302.3.1 Nonseparated Uses. Each portion of the building shall be individually classified as to use. The required type of construction for the building shall be determined by applying the height and area limitations for each of the applicable occupancies to the entire building. The most restrictive type of construction, so determined, shall apply to the entire building. All other code requirements shall apply to each portion of the building based on the use of that space except that the most restrictive applicable provisions of 780 CMR 403.0 and 780 CMR 9.00 shall apply to these nonseparated uses. Fire separations are not required between uses, except as required by other provisions.

302.3.2 Separated Uses. Each portion of the building shall be individually classified as to use and shall be completely separated from adjacent areas by fire barrier walls or horizontal assemblies or both having a fire-resistance rating determined in accordance with Table 302.3.2 for uses being separated. Each fire area shall comply with 780 CMR based on the use of that space. Each fire area shall comply with the height limitations based on the use of that space and the type of construction classification. In each story, the building area shall be such that the sum of the ratios of the floor area of each use divided by the allowable area for each use shall not exceed one.

Exception: Except for Group H and I-2 areas, where the building is equipped throughout with an automatic sprinkler system, installed in accordance with 780 CMR 903.3.1.1, the fire-resistance ratings in Table 302.3.3 shall be reduced by one hour but to not less than 1 hour and to not less than that required for floor construction according to the type of construction.

302.4 Spaces Used for Different Purposes. A room or space that is intended to be occupied at different times for different purposes shall comply with all the requirements that are applicable to each of the purposes for which the room or space will be occupied.

TABLE 302.3.2 REQUIRED SEPARATION OF OCCUPANCIES (HOURS)

TABLE 302.3.2
REQUIRED SEPARATION OF OCCUPANCIES (HOURS)^{a}

USE	A-1	A-2	A-3	A-4	A-5	B^{b}	E	F-1	F-2	H-1	H-2	H-3	H-4	H-5	I-1	I-2	I-3	I-4	M^{b}	R-1	R-2	R-3, R-4	S-1	S-2^{c}	U
A-1	—	2	2	2	2	2	2	3	2	NP	4	3	2	4	2	2	2	2	2	2	2	2	3	2	1
A-2^{e}	—	—	2	2	2	2	2	3	2	NP	4	3	2	4	2	2	2	2	2	2	2	2	3	2	1
A-3	—	—	—	2	2	2	2	3	2	NP	4	3	2	4	2	2	2	2	2	2	2	2	3	2	1
A-4	—	—	—	—	2	2	2	3	2	NP	4	3	2	4	2	2	2	2	2	2	2	2	3	2	1
A-5	—	—	—	—	—	2	2	3	2	NP	4	3	2	4	2	2	2	2	2	2	2	2	3	2	1
B^{b}	—	—	—	—	—	—	2	3	2	NP	2	1	1	1	2	2	2	2	2	2	2	2	3	2	1
E	—	—	—	—	—	—	—	3	2	NP	4	3	2	3	2	2	2	2	2	2	2	2	3	2	1
F-1	—	—	—	—	—	—	—	—	3	NP	2	1	1	1	3	3	3	3	3	3	3	3	3	3	3
F-2	—	—	—	—	—	—	—	—	—	NP	2	1	1	1	2	2	2	2	2	2	2	2	3	2	1
H-1	—	—	—	—	—	—	—	—	—	—	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP
H-2	—	—	—	—	—	—	—	—	—	—	—	1	2	2	4	4	4	4	2	4	4	4	2	2	1
H-3	—	—	—	—	—	—	—	—	—	—	—	—	1	1	4	3	3	3	1	3	3	3	1	1	1
H-4	—	—	—	—	—	—	—	—	—	—	—	—	—	1	4	4	4	4	1	4	4	4	1	1	1
H-5	—	—	—	—	—	—	—	—	—	—	—	—	—	—	4	4	4	3	1	4	4	4	1	1	3
I-1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	2	2	2	2	2	2	2	4	3	2
I-2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	2	2	2	2	2	2	3	2	1
I-3	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	2	2	2	2	2	3	2	1
I-4	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	2	2	2	2	3	2	1
M^{b}	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	2	2	2	3	2	1
R-1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	2	2	3	2	1
R-2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	2	3	2	1
R-3, R-4	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	3	2^{d}	1^{d}
S-1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	3	3
S-2^{c}	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1
U	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

For SI: 1 square foot = 0.0929 m^{2}.

NP = Not permitted.

a. See exception to Section 302.3.2 for reductions permitted.

b. Occupancy separation need not be provided for storage areas within Groups B and M if the:

1. Area is less than 10 percent of the floor area;
2. Area is provided with an automatic fire-extinguishing system and is less than 3,000 square feet; or
3. Area is less than 1,000 square feet.

c. Areas used only for private or pleasure vehicles shall be allowed to reduce separation by 1 hour.

d. See Section 406.1.4.

e. Commercial kitchens need not be separated from the restaurant seating areas that they serve.

780 CMR 303.0 ASSEMBLY GROUP A

303.1 Assembly Group A. Assembly Group A occupancy includes, among others, the use of a building or structure, or a portion thereof, for the gathering together of persons for purposes such as civic, social or religious functions, recreation, food or drink consumption or awaiting transportation. A room or space used for assembly purposes by less than 50 persons and accessory to another occupancy shall be included as a part of that occupancy. Assembly areas with less than 750 square feet (69.7 m^2) and which are accessory to another occupancy according to 780 CMR 302.2.1 are not assembly occupancies. Assembly occupancies which are accessory to Group E in accordance with 780 CMR 302.2 are not considered assembly occupancies. Religious educational rooms and religious auditoriums which are accessory to churches in accordance with 780 CMR 302.2 and which have occupant loads of less than 100 shall be classified as A-3.

Assembly occupancies shall include the following:

(1) **A-1** Assembly uses, usually with fixed seating, intended for the production and viewing of the performing arts or motion pictures including, but not limited to:

- (a) Motion picture theaters
- (b) Symphony and concert halls
- (c) Television and radio studios admitting an audience
- (d) Theaters

(2) ***A-2 Assembly uses intended for food and/or drink consumption shall be further categorized as A-2r and A-2nc (where A-2nc is the Assembly USE designation narrow to night clubs and A-2r is the USE designation for A-2 USES other than night clubs); A-2 USES include but are not limited to:***

- (a) Banquet halls
- (b) Night clubs
- (c) Restaurants
- (d) Taverns and bars

Note: independent of the "A-2" USE Classification set forth in 780 CMR 303.1(2), requirements associated with M.G.L. c. 148, § 26G.5, M.G.L. c. 148A, M.G.L. c. 143, § 97A – all such General Laws related to St. 2004, c. 304 - could ultimately result in an A-2r USE being reclassified as an A-2nc USE.

(3) **A-3** Assembly uses intended for worship, recreation or amusement and other assembly uses not classified elsewhere in Group A including, but not limited to:

- (a) Amusement arcades
- (b) Art galleries
- (c) Bowling alleys
- (d) Churches
- (e) Community halls
- (f) Courtrooms
- (g) Dance halls (not including food or drink consumption)
- (h) Exhibition halls
- (i) Funeral parlors
- (j) Gymnasiums (without spectator seating)
- (k) Indoor swimming pools (without spectator seating)
- (l) Indoor tennis courts (without spectator seating)
- (m) Lecture halls
- (n) Libraries
- (o) Museums
- (p) Waiting areas in transportation terminals
- (q) Pool and billiard parlors

(4) **A-4** Assembly uses intended for viewing of indoor sporting events and activities with spectator seating including, but not limited to:

- (a) Arenas
- (b) Skating rinks
- (c) Swimming pools
- (d) Tennis courts

(5) **A-5** Assembly uses intended for participation in or viewing outdoor activities including, but not limited to:

- (a) Amusement park structures
- (b) Bleachers
- (c) Grandstands
- (d) Stadiums

303.1.1 Nonaccessory Assembly Use. A building or tenant space used for assembly purposes by less than 50 persons shall be considered a Group B occupancy.

780 CMR 304.0 BUSINESS GROUP B

304.1 Business Group B. Business Group B occupancy includes, among others, the use of a building or structure, or a portion thereof, for office, professional or service-type transactions, including storage of records and accounts. Business occupancies shall include, but not be limited to, the following:

- (1) Airport traffic control towers
- (2) Animal hospitals, kennels and pounds
- (3) Banks
- (4) Barber and beauty shops
- (5) Car wash
- (6) Civic administration
- (7) Clinic—outpatient
- (8) Dry cleaning and laundries; pick-up and delivery stations and self-service
- (9) Educational occupancies above the 12th grade
- (10) Electronic data processing
- (11) Laboratories; testing and research
- (12) Motor vehicle showrooms
- (13) Post offices
- (14) Print shops
- (15) Professional services (architects, attorneys, dentists, physicians, engineers, etc.)

(16) Radio and television stations
(17) Telephone exchanges

780 CMR 305.0 EDUCATIONAL GROUP E

305.1 Educational Group E. Educational Group E occupancy includes, among others, the use of a building or structure, or a portion thereof, by six or more persons at any one time for educational purposes through the 12th grade. Religious educational rooms and religious auditoriums, which are accessory to churches in accordance with 780 CMR 302.2 and have occupant loads of less than 100, shall be classified as A-3 occupancies.

305.2 Day Care. In conjunction with the additional applicable requirements of 780 CMR, 422, the use of a building or structure, or portion thereof, for educational, supervision or personal care services for children older than two years and nine months years of age, shall be classified as a Group E occupancy (also see 780 CMR 308.5) – Note however, that the express Special Use and Occupancy requirements of 780 CMR 422.0, for Day care occupancies shall override the general requirements and limitations of E and I USE.

780 CMR 306.0 FACTORY GROUP F

306.1 Factory Industrial Group F. Factory Industrial Group F occupancy includes, among others, the use of a building or structure, or a portion thereof, for assembling, disassembling, fabricating, finishing, manufacturing, packaging, repair or processing operations that are not classified as a Group H hazardous or Group S storage occupancy.

306.2 Factory Industrial F-1 Moderate-Hazard Occupancy. Factory industrial uses which are not classified as Factory Industrial F-2 Low Hazard shall be classified as F-1 Moderate Hazard and shall include, but not be limited to, the following:

(1) Aircraft
(2) Appliances
(3) Athletic equipment
(4) Automobiles and other motor vehicles
(5) Bakeries
(6) Beverages; over 12% alcohol content
(7) Bicycles
(8) Boats
(9) Brooms or brushes
(10) Business machines
(11) Cameras and photo equipment
(12) Canvas or similar fabric
(13) Carpets and rugs (includes cleaning)
(14) Clothing
(15) Construction and agricultural machinery
(16) Disinfectants
(17) Dry cleaning and dyeing
(18) Electric generation plants
(19) Electronics
(20) Engines (including rebuilding)
(21) Food processing
(22) Furniture
(23) Hemp products
(24) Jute products
(25) Laundries
(26) Leather products
(27) Machinery
(28) Metals
(29) Millwork (sash & door)
(30) Motion pictures and television filming (without spectators)
(31) Musical instruments
(32) Optical goods
(33) Paper mills or products
(34) Photographic film
(35) Plastic products
(36) Printing or publishing
(37) Recreational vehicles
(38) Refuse incineration
(39) Shoes
(40) Soaps and detergents
(41) Textiles
(42) Tobacco
(43) Trailers
(44) Upholstering
(45) Wood; distillation
(46) Woodworking (cabinet)

306.3 Factory Industrial F-2 Low-Hazard Occupancy. Factory industrial uses that involve the fabrication or manufacturing of noncombustible materials which during finishing, packing or processing do not involve a significant fire hazard shall be classified as F-2 occupancies and shall include, but not be limited to, the following:

(1) Beverages; up to and including 12% alcohol content
(2) Brick and masonry
(3) Ceramic products
(4) Foundries
(5) Glass products
(6) Gypsum
(7) Ice
(8) Metal products (fabrication and assembly)

780 CMR 307.0 HIGH-HAZARD GROUP H

[F] 307.1 High-Hazard Group H. High-Hazard Group H occupancy includes, among others, the use of a building or structure, or a portion thereof, that involves the manufacturing, processing, generation or storage of materials that constitute a physical or health hazard in quantities in excess of those found in Tables 307.7(1) and 307.7(2) (*See* also definition of "Control area").

[F] 307.2 Definitions. The following words and terms shall, for the purposes of 780 CMR 307.0 and as used elsewhere in 780 CMR, have the meanings shown in 780 CMR 307.2.

AEROSOL. A product that is dispensed from an aerosol container by a propellant.

Aerosol products shall be classified by means of the calculation of their chemical heats of combustion and shall be designated Level 1, 2 or 3.

Level 1 Aerosol Products. Those with a total chemical heat of combustion that is less than or equal to 8,600 British thermal units per pound (Btu/lb) (20 kJ/g).

Level 2 Aerosol Products. Those with a total chemical heat of combustion that is greater than 8,600 Btu/lb (20 kJ/g), but less than or equal to 13,000 Btu/lb (30 kJ/g).

Level 3 Aerosol Products. Those with a total chemical heat combustion that is greater than 13,000 Btu/lb (30 kJ/g).

AEROSOL CONTAINER. A metal can or a glass or plastic bottle designed to dispense an aerosol. Metal cans shall be limited to a maximum size of 33.8 fluid ounces (1,000 ml). Glass or plastic bottles shall be limited to a maximum size of 4 fluid ounces (118 ml).

BARRICADE. A structure that consists of a combination of walls, floor and roof, which is designed to withstand the rapid release of energy in an explosion and which is fully confined, partially vented or fully vented; or other effective method of shielding from explosive materials by a natural or artificial barrier.

Artificial Barricade. An artificial mound or revetment a minimum thickness of 3 feet (914 mm).

Natural Barricade. Natural features of the ground, such as hills, or timber of sufficient density that the surrounding exposures that require protection cannot be seen from the magazine or building containing explosives when the trees are bare of leaves.

BOILING POINT. The temperature at which the vapor pressure of a liquid equals the atmospheric pressure of 14.7 pounds per square inch (psi) (101 kPa) gage or 760 mm of mercury. Where an accurate boiling point is unavailable for the material in question, or for mixtures which do not have a constant boiling point, for the purposes of this classification, the 20% evaporated point of a distillation performed in accordance with ASTM D 86 shall be used as the boiling point of the liquid.

CLOSED SYSTEM. The use of a solid or liquid hazardous material involving a closed vessel or system that remains closed during normal operations where vapors emitted by the product are not liberated outside of the vessel or system and the product is not exposed to the atmosphere during normal operations; and all uses of compressed gases. Examples of closed systems for solids and liquids include product conveyed through a piping system into a closed vessel, system or piece of equipment.

COMBUSTIBLE DUST. Finely divided solid material that is 420 microns or less in diameter and which, when dispersed in air in the proper proportions, could be ignited by a flame, spark or other source of ignition. Combustible dust will pass through a U.S. No. 40 standard sieve.

COMBUSTIBLE FIBERS. Readily ignitable and free-burning fibers, such as cocoa fiber, cloth, cotton, excelsior, hay, hemp, henequen, istle, jute, kapok, oakum, rags, sisal, Spanish moss, straw, tow, wastepaper, certain synthetic fibers or other like materials.

COMBUSTIBLE LIQUID. A liquid having a closed cup flash point at or above 100°F (38°C). Combustible liquids shall be subdivided as follows:

Class II. Liquids having a closed cup flash point at or above 100°F (38°C) and below 140°F (60°C).

Class IIIA. Liquids having a closed cup flash point at or above 140°F (60°C) and below 200°F (93°C).

Class IIIB. Liquids having a closed cup flash point at or above 200°F (93°C).

The category of combustible liquids does not include compressed gases or cryogenic fluids.

TABLE 307.7(1) MAXIMUM ALLOWABLE QUANTITY PER CONTROL AREA OF HAZARDOUS MATERIALS POSING A PHYSICAL HAZARD

[F] TABLE 307.7(1)
MAXIMUM ALLOWABLE QUANTITY PER CONTROL AREA OF HAZARDOUS MATERIALS POSING A PHYSICAL HAZARD[a, j, m, n]

MATERIAL	CLASS	GROUP WHEN THE MAXIMUM ALLOWABLE QUANTITY IS EXCEEDED	STORAGE[b]			USE-CLOSED SYSTEMS[b]			USE-OPEN SYSTEMS[b]	
			Solid pounds (cubic feet)	Liquid gallons (pounds)	Gas (cubic feet at NTP)	Solid pounds (cubic feet)	Liquid gallons (pounds)	Gas (cubic feet at NTP)	Solid pounds (cubic feet)	Liquid gallons (pounds)
Combustible liquid[c, i]	II IIIA IIIB	H-2 or H-3 H-2 or H-3 N/A	N/A	120[d, e] 330[d, e] 13,200[e, f]	N/A	N/A	120[d] 330[d] 13,200[f]	N/A	N/A	30[d] 80[d] 3,300[f]
Combustible fiber	Loose Baled	H-3	(100) (1,000)	N/A	N/A	(100) (1,000)	N/A	N/A	(20) (200)	N/A
Consumer fireworks (Class C, Common)	1.4G	H-3	125[d, e, l]	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cryogenics flammable	N/A	H-2	N/A	45[d]	N/A	N/A	45[d]	N/A	N/A	10[d]
Cryogenics, oxidizing	N/A	H-3	N/A	45[d]	N/A	N/A	45[d]	N/A	N/A	10[d]
Explosives	Division 1.1 Division 1.2 Division 1.3 Division 1.4 Division 1.4G Division 1.5 Division 1.6	H-1 H-1 H-1 or 2 H-3 H-3 H-1 H-1	1[e, g] 1[e, g] 5[e, g] 50[e, g] 125[d, e, l] 1[e, g] 1[d, e, g]	(1)[e, g] (1)[e, g] (5)[e, g] (50)[e, g] N/A (1)[e, g] N/A	N/A N/A N/A N/A N/A N/A N/A	0.25[g] 0.25[g] 1[g] 50[g] N/A 0.25[g] N/A	(0.25)[g] (0.25)[g] (1)[g] (50)[g] N/A (0.25)[g] N/A	N/A N/A N/A N/A N/A N/A N/A	0.25[g] 0.25[g] 1[g] N/A N/A 0.25[g] N/A	(0.25)[g] (0.25)[g] (1)[g] N/A N/A (0.25)[g] N/A
Flammable gas	Gaseous liquefied	H-2	N/A	N/A 30[d, e]	1,000[d, e] N/A	N/A	N/A 30[d, e]	1,000[d, e] N/A	N/A	N/A
Flammable liquid[c]	1A 1B and 1C	H-2 or H-3	N/A	30[d, e] 120[d, e]	N/A	N/A	30[d] 120[d]	N/A	N/A	10[d] 30[d]
Combination flammable liquid (1A, 1B, 1C)	N/A	H-2 or H-3	N/A	120[d, e, h]	N/A	N/A	120[d, h]	N/A	N/A	30[d, h]
Flammable solid	N/A	H-3	125[d, e]	N/A	N/A	125[d]	N/A	N/A	25[d]	N/A
Organic peroxide	UD I II III IV V	H-1 H-2 H-3 H-3 N/A N/A	1[e, g] 5[d, e] 50[d, e] 125[d, e] NL NL	(1)[e, g] (5)[d, e] (50)[d, e] (125)[d, e] NL NL	N/A N/A N/A N/A N/A N/A	0.25[g] 1[d] 50[d] 125[d] N/L N/L	(0.25)[g] (1) (50)[d] (125)[d] N/L N/L	N/A N/A N/A N/A N/A N/A	0.25[g] 1[d] 10[d] 25[d] NL NL	(0.25)[g] (1)[d] (10)[d] (25)[d] NL NL
Oxidizer	4 3[k] 2 1	H-1 H-2 or H-3 H-3 N/A	1[e, g] 10[d, e] 250[d, e] 4,000[e, f]	(1)[e, g] (10)[d, e] (250)[d, e] (4,000)[e, f]	N/A N/A N/A N/A	0.25[g] 2[d] 250[d] 4,000[f]	(0.25)[g] (2)[d] (250)[d] (4,000)[f]	N/A N/A N/A N/A	0.25[g] 2[d] 50[d] 1,000[f]	(0.25)[g] (2)[d] (50)[d] (1,000)[f]
Oxidizing gas	Gaseous liquefied	H-3	N/A N/A	N/A 15[d, e]	1,500[d, e] N/A	N/A N/A	N/A 15[d, e]	1,500[d, e] N/A	N/A N/A	N/A N/A

(continued)

[F] TABLE 307.7(1)—continued
MAXIMUM ALLOWABLE QUANTITY PER CONTROL AREA OF HAZARDOUS MATERIALS POSING A PHYSICAL HAZARD[a, j, m, n]

MATERIAL	CLASS	GROUP WHEN THE MAXIMUM ALLOWABLE QUANTITY IS EXCEEDED	STORAGE[b]			USE-CLOSED SYSTEMS[b]			USE-OPEN SYSTEMS[b]	
			Solid pounds (cubic feet)	Liquid gallons (pounds)	Gas (cubic feet at NTP)	Solid pounds (cubic feet)	Liquid gallons (pounds)	Gas (cubic feet at NTP)	Solid pounds (cubic feet)	Liquid gallons (pounds)
Pyrophoric material	N/A	H-2	4[e, g]	(4)[e, g]	50[e, g]	1[g]	(1)[g]	10[e, g]	0	0
Unstable (reactive)	4	H-1	1[e, g]	(1)[e, g]	10[d, g]	0.25[g]	(0.25)[g]	2[e, g]	0.25[g]	(0.25)[g]
	3	H-1 or H-2	5[d, e]	(5)[d, e]	50[d, e]	1[d]	(1)	10[d, e]	1[d]	(1)[d]
	2	H-3	50[d, e]	(50)[d, e]	250[d, e]	50[d]	(50)[d]	250[d, e]	10[d]	(10)[d]
	1	N/A	NL	NL	N/L	NL	N/L	NL	NL	NL
Water reactive	3	H-2	5[d, e]	(5)[d, e]	N/A	5[d]	(5)[d]	N/A	1[d]	(1)[d]
	2	H-3	50[d, e]	(50)[d, e]	N/A	50[d]	(50)[d]	N/A	10[d]	(10)[d]
	1	N/A	NL	NL	N/A	NL	NL	N/A	NL	NL

For SI: 1 cubic foot = 0.023 m^3, 1 pound = 0.454 kg, 1 gallon = 3.785 L.

NL = Not Limited; N/A = Not Applicable; UD = Unclassified Detonable

a. For use of control areas, see Section 414.2.

b. The aggregate quantity in use and storage shall not exceed the quantity listed for storage.

c. The quantities of alcoholic beverages in retail and wholesale sales occupancies shall not be limited providing the liquids are packaged in individual containers not exceeding 1.3 gallons. In retail and wholesale sales occupancies, the quantities of medicines, foodstuffs, consumer or industrial products, and cosmetics containing not more than 50 percent by volume of water-miscible liquids with the remainder of the solutions not being flammable, shall not be limited, provided that such materials are packaged in individual containers not exceeding 1.3 gallons.

d. Maximum allowable quantities shall be increased 100 percent in buildings equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1. Where Note e also applies, the increase for both notes shall be applied accumulatively.

e. Maximum allowable quantities shall be increased 100 percent when stored in approved storage cabinets, gas cabinets, exhausted enclosures or safety cans as specified in the *International Fire Code*. Where Note d also applies, the increase for both notes shall be applied accumulatively.

f. The permitted quantities shall not be limited in a building equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1.

g. Permitted only in buildings equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1.

h. Containing not more than the maximum allowable quantity per control area of Class IA, IB or IC flammable liquids.

i. Inside a building, the maximum capacity of a combustible liquid storage system that is connected to a fuel-oil piping system shall be 660 gallons provided such system complies with the *International Fire Code*.

j. Quantities in parenthesis indicate quantity units in parenthesis at the head of each column.

k. A maximum quantity of 200 pounds of solid or 20 gallons of liquid Class 3 oxidizers is allowed when such materials are necessary for maintenance purposes, operation or sanitation of equipment. Storage containers and the manner of storage shall be approved.

l. Net weight of the pyrotechnic composition of the fireworks. Where the net weight of the pyrotechnic composition of the fireworks is not known, 25 percent of the gross weight of the fireworks, including packaging, shall be used.

m. For gallons of liquids, divide the amount in pounds by 10 in accordance with Section 2703.1.2 of the *International Fire Code*.

n. For storage and display quantities in Group M and storage quantities in Group S occupancies complying with Section 414.2.4, see Table 414.2.4.

TABLE 307.7(2) MAXIMUM ALLOWABLE QUANTITY PER CONTROL AREA OF HAZARDOUS MATERIALS POSING A HEALTH HAZARD[a, b, c, j]

MATERIAL	STORAGE[d]			USE-CLOSED SYSTEMS[d]			USE-OPEN SYSTEMS[d]	
	Solid poundse, [f]	Liquid gallons (pounds)e,	Gas (cubic feet at NTP)[e]	Solid pounds[e]	Liquid gallons (pounds)[e]	Gas (cubic feet at NTP)[e]	Solid pounds[e]	Liquid gallons (pounds)[e]
Corrosive	5000	500	810f, [g]	5000	500	810f, [g]	1000	100
Highly toxic	10	(10)[i]	20[h]	10	(10)[i]	20[h]	3	(3)[i]
Toxic	500	(500)[i]	810[f]	500	(500)[i]	810[f]	125	(125)i

For SI: 1 cubic foot = 0.028 m^3, 1 pound = 0.454 kg, 1 gallon = 3.785 L.

a. For use of control areas, see 780 CMR 414.2.

b. In retail and wholesale sales occupancies, the quantities of medicines, foodstuffs, consumer or industrial products, and cosmetics, containing not more than 50% by volume of water-miscible liquids and with the remainder of the solutions not being flammable, shall not be limited, provided that such materials are packaged in individual containers not exceeding 1.3 gallons.

c. For storage and display quantities in Group M and storage quantities in Group S occupancies complying with 780 CMR 414.2.4, see Table 414.2.4.

d. The aggregate quantity in use and storage shall not exceed the quantity listed for storage.

e. Quantities shall be increased 100%t in buildings equipped throughout with an approved automatic sprinkler system in accordance with 780CMR 903 .3.1.1. Where Note f also applies, the increase for both notes shall be applied accumulatively.

f. Quantities shall be increased 100% when stored in approved storage cabinets, gas cabinets or exhausted enclosures as specified in the *International Fire Code*. Where Note e also applies, the increase for both notes shall be applied accumulatively.

g. A single cylinder containing 150 pounds or less of anhydrous ammonia in a single control area in a nonsprinklered building shall be considered a maximum allow able quantity. Two cylinders, each containing 150 pounds or less in a single control area, shall be considered a maximum allowable quantity provided the building is equipped throughout with an automatic sprinkler system in accordance with 780 CMR 903.3.1.1.

h. Allowed only when stored in approved exhausted gas cabinets or exhausted enclosures as specified in the *International Fire Code*.

i. Quantities in parenthesis indicate quantity units in parenthesis at the head of each column.

j. For gallons of liquids, divide the amount in pounds by ten in accordance with Section 2703.1.2 of the *International Fire Code*.

COMPRESSED GAS. A material, or mixture of materials which:

1. Is a gas at 68°F (20°C) or less at 14.7 pounds per square inch atmosphere (psia) (101 kPa) of pressure; and
2. Has a boiling point of 68°F (20°C) or less at 14.7 psia (101 kPa) which is either liquefied, nonliquefied or in solution, except those gases which have no other health- or physical-hazard properties are not considered to be compressed until the pressure in the packaging exceeds 41 psia (282 kPa) at 68°F (20°C).

The states of a compressed gas are categorized as follows:

3. Nonliquefied compressed gases are gases, other than those in solution, which are in a packaging under the charged pressure and are entirely gaseous at a temperature of 68°F (20°C).
4. Liquefied compressed gases are gases that, in a packaging under the charged pressure, are partially liquid at a temperature of 68F (20°C).
5. Compressed gases in solution are nonliquefied gases that are dissolved in a solvent.
4. Compressed gas mixtures consist of a mixture of two or more compressed gases contained in a packaging, the hazard properties of which are represented by the properties of the mixture as a whole.

CONTROL AREA. Spaces within a building that are enclosed and bounded by exterior walls, fire walls, fire barriers and roofs, or a combination thereof, where quantities of hazardous materials not exceeding the maximum allowable quantities per control area are stored, dispensed, used or handled.

CORROSIVE. A chemical that causes visible destruction of, or irreversible alterations in, living tissue by chemical action at the point of contact. A chemical shall be considered corrosive if, when tested on the intact skin of albino rabbits by the method described in DOTn 49 CFR, Part 173.137, such a chemical destroys or changes irreversibly the structure of the tissue at the point of contact following an exposure period of 4 hours. This term does not refer to action on inanimate surfaces.

CRYOGENIC FLUID. A liquid having a boiling point lower than -150°F (-101°C) at 14.7 pounds per square inch atmosphere (psia) (an absolute pressure of 101 kPa).

DEFLAGRATION. An exothermic reaction, such as the extremely rapid oxidation of a flammable dust or vapor in air, in which the reaction progresses through the unburned material at a rate less than the velocity of sound. A deflagration can have an explosive effect.

DETACHED BUILDING. A separate single-story building, without a basement or crawl space, used for the storage or use of hazardous materials and located an approved distance from all structures.

DETONATION. An exothermic reaction characterized by the presence of a shock wave in the material which establishes and maintains the reaction. The reaction zone progresses through the material at a rate greater than the velocity of sound. The principal heating mechanism is one of shock compression. Detonations have an explosive effect.

DISPENSING. The pouring or transferring of any material from a container, tank or similar vessel, whereby vapors, dusts, fumes, mists or gases are liberated to the atmosphere.

EXPLOSIVE. Any chemical compound, mixture or device, the primary or common purpose of which is to function by explosion. The term includes, but is not limited to, dynamite, black powder, pellet powder, initiating explosives, detonators, safety fuses, squibs, detonating cord, igniter cord, igniters and display fireworks, 1.3G (Class B, Special).

The term "explosive" includes any material determined to be within the scope of USC Title 18: Chapter 40 and also includes any material classified as an explosive other than consumer fireworks, 1.4G (Class C, Common) by the hazardous materials regulations of DOTn 49 CFR.

High Explosive. Explosive material, such as dynamite, which can be caused to detonate by means of a No. 8 test blasting cap when unconfined.

Low Explosive. Explosive material that will burn or deflagrate when ignited. It is characterized by a rate of reaction that is less than the speed of sound. Examples of low explosives include, but are not limited to, black powder; safety fuse; igniters; igniter cord; fuse lighters; fireworks, 1.3G (Class B, Special) and propellants, 1.3C.

Mass-detonating Explosives. Division 1.1, 1.2 and 1.5 explosives alone or in combination, or loaded into various types of ammunition or containers, most of which can be expected to explode virtually instantaneously when a small portion is subjected to fire, severe concussion, impact, the impulse of an initiating agent or the effect of a considerable discharge of energy from without. Materials that react in this manner represent a mass explosion hazard. Such an explosive will normally cause severe structural damage to adjacent objects. Explosive propagation could occur immediately to other items of ammunition and explosives stored sufficiently close to and not adequately protected from the initially exploding pile with a time interval short enough so that two or more quantities must be considered as one for quantity-distance purposes.

UN/DOTn CLASS 1 EXPLOSIVES. The former classification system used by DOTn included the terms "high" and "low" explosives as defined herein. The following terms further define explosives under the current system applied by DOTn for all explosive materials defined as hazard Class 1 materials. Compatibility group letters are used in concert with the division to specify further limitations on each division noted (i.e., the letter G identifies the material as a pyrotechnic substance or article containing a pyrotechnic substance and similar materials).

Division 1.1. Explosives that have a mass explosion hazard. A mass explosion is one which affects almost the entire load instantaneously.

Division 1.2. Explosives that have a projection hazard but not a mass explosion hazard.

Division 1.3. Explosives that have a fire hazard and either a minor blast hazard or a minor projection hazard or both, but not a mass explosion hazard.

Division 1.4. Explosives that pose a minor explosion hazard. The explosive effects are largely confined to the package and no projection of fragments of appreciable size or range is to be expected. An external fire must not cause virtually instantaneous explosion of almost the entire contents of the package.

Division 1.5. Very insensitive explosives. This division is comprised of substances that have a mass explosion hazard, but that are so insensitive there is very little probability of initiation or of transition from burning to detonation under normal conditions of transport.

Division 1.6. Extremely insensitive articles which do not have a mass explosion hazard. This division is comprised of articles that contain only extremely insensitive detonating substances and which demonstrate a negligible probability of accidental initiation or propagation.

FIREWORKS. Any composition or device for the purpose of producing a visible or audible effect for entertainment purposes by combustion, deflagration or detonation that meets the definition of 1.4G fireworks or 1.3G fireworks as set forth herein.

FIREWORKS, 1.3G. (Formerly Class B, Special Fireworks.) Large fireworks devices, which are explosive materials, intended for use in fireworks displays and designed to produce audible or visible effects by combustion, deflagration or detonation. Such 1.3G fireworks include, but are not limited to, firecrackers containing more than 130 milligrams (two grains) of explosive composition, aerial shells containing more than 40 grams of pyrotechnic composition, and other display pieces which exceed the limits for classification as 1.4G fireworks. Such 1.3G fireworks are also described as fireworks, 49 CFR (172) by the DOTn.

FIREWORKS, 1.4G. (Formerly Class C, Common Fireworks.) Small fireworks devices containing restricted amounts of pyrotechnic composition designed primarily to produce visible or audible effects by combustion. Such 1.4G fireworks which comply with the construction, chemical composition and labeling regulations of the DOTn for fireworks, 49 CFR (172), and the U.S. Consumer Product Safety Commission (CPSC) as set forth in CPSC 16 CFR: Parts 1500 and 1507, are not explosive materials for the purpose of 780 CMR.

FLAMMABLE GAS. A material that is a gas at 68°F (20°C) or less at 14.7 pounds per square inch atmosphere (psia) (101 kPa) of pressure [a material that has a boiling point of 68°F (20°C) or less at 14.7 psia (101 kPa)] which:

(1) Is ignitable at 14.7 psia (101 kPa) when in a mixture of 13% or less by volume with air; or

(2) Has a flammable range at 14.7 psia (101 kPa) with air of at least 12%, regardless of the lower limit.

The limits specified shall be determined at 14.7 psi (101 kPa) of pressure and a temperature of 68°F (20°C) in accordance with ASTM E 681.

FLAMMABLE LIQUEFIED GAS. A liquefied compressed gas which, under a charged pressure, is partially liquid at a temperature of 68°F (20°C) and which is flammable.

FLAMMABLE LIQUID. A liquid having a closed cup flash point below 100°F (38°C). Flammable liquids are further categorized into a group known as Class I liquids. The Class I category is subdivided as follows:

Class IA. Liquids having a flash point below 73°F (23°C) and a boiling point below 100°F (38°C).

Class IB. Liquids having a flash point below 73°F (23°C) and a boiling point at or above 100°F (38°C).

Class IC. Liquids having a flash point at or above 73°F (23°C) and below 100°F (38°C).

The category of flammable liquids does not include compressed gases or cryogenic fluids.

FLAMMABLE MATERIAL. A material capable of being readily ignited from common sources of heat or at a temperature of 600°F (316°C) or less.

FLAMMABLE SOLID. A solid, other than a blasting agent or explosive, that is capable of causing fire through friction, absorption or moisture, spontaneous chemical change, or retained heat from manufacturing or processing, or which has an ignition temperature below 212°F (100°C) or which burns so vigorously and persistently when ignited as to create a serious hazard. A chemical shall be considered a flammable solid as determined in accordance with the test method of CPSC 16 CFR; Part 1500.44, if it ignites and burns with a self-sustained flame at a rate greater than 0.1 inch (2.5 mm) per second along its major axis.

FLASH POINT. The minimum temperature in degrees Fahrenheit at which a liquid will give off sufficient vapors to form an ignitable mixture with air near the surface or in the container, but will not sustain combustion. The flash point of a liquid shall be determined by appropriate test procedure and apparatus as specified in ASTM D 56, ASTM D 93 or ASTM D 3278.

HANDLING. The deliberate transport by any means to a point of storage or use.

HAZARDOUS MATERIALS. Those chemicals or substances that are physical hazards or health hazards as defined and classified in 780 CMR 307.0, the *International Fire Code* and 527 CMR, whether the materials are in usable or waste condition.

HEALTH HAZARD. A classification of a chemical for which there is statistically significant evidence that acute or chronic health effects are capable of occurring in exposed persons. The term "health hazard" includes chemicals that are toxic or highly toxic, and corrosive.

HIGHLY TOXIC. A material which produces a lethal dose or lethal concentration that falls within any of the following categories:

1. A chemical that has a median lethal dose (LD50) of 50 milligrams or less per kilogram of body weight when administered orally to albino rats weighing between 200 and 300 grams each.
2. A chemical that has a median lethal dose (LD50) of 200 milligrams or less per kilogram of body weight when administered by continuous contact for 24 hours (or less if death occurs within 24 hours) with the bare skin of albino rabbits weighing between 2 and 3 kilograms each.
3 A chemical that has a median lethal concentration (LC50) in air of 200 parts per million by volume or less of gas or vapor, or 2 milligrams per liter or less of mist, fume or dust, when administered by continuous inhalation for 1 hour (or less if death occurs within 1 hour) to albino rats weighing between 200 and 300 grams each.

Mixtures of these materials with ordinary materials, such as water, might not warrant classification as highly toxic. While this system is basically simple in application, any hazard evaluation that is required for the precise categorization of this type of material shall be performed by experienced, technically competent persons.

INCOMPATIBLE MATERIALS. Materials that, when mixed, have the potential to react in a manner that generates heat, fumes, gases or byproducts which are hazardous to life or property.

OPEN SYSTEM. The use of a solid or liquid hazardous material involving a vessel or system that is continuously open to the atmosphere during normal operations and where vapors are liberated, or the product is exposed to the atmosphere during normal operations. Examples of open systems for solids and liquids include dispensing from or into open beakers or containers, dip tank and plating tank operations.

OPERATING BUILDING. A building occupied in conjunction with the manufacture, transportation or use of explosive materials. Operating buildings are separated from one another with the use of intraplant or intraline distances.

ORGANIC PEROXIDE. An organic compound that contains the bivalent -O-O- structure and which may be considered to be a structural derivative of hydrogen peroxide where one or both of the hydrogen atoms have been replaced by an organic radical. Organic peroxides can pose an explosion hazard (detonation or deflagration) or they can be shock sensitive. They can also decompose into various unstable compounds over an extended period of time.

Class I. Those formulations that are capable of deflagration but not detonation.

Class II. Those formulations that burn very rapidly and that pose a moderate reactivity hazard.

Class III. Those formulations that burn rapidly and that pose a moderate reactivity hazard.

Class IV. Those formulations that burn in the same manner as ordinary combustibles and that pose a minimal reactivity hazard.

Class V. Those formulations that burn with less intensity than ordinary combustibles or do not sustain combustion and that pose no reactivity hazard.

Unclassified Detonable. Organic peroxides that are capable of detonation. These peroxides pose an extremely high explosion hazard through rapid explosive decomposition.

OXIDIZER. A material that readily yields oxygen or other oxidizing gas, or that readily reacts to promote or initiate combustion of combustible materials. Examples of other oxidizing gases include bromine, chlorine and fluorine.

Class 4. An oxidizer that can undergo an explosive reaction due to contamination or exposure to thermal or physical shock. Additionally, the oxidizer will enhance the burning rate and can cause spontaneous ignition of combustibles.

Class 3. An oxidizer that will cause a severe increase in the burning rate of combustible materials with which it comes in contact or that will undergo vigorous self-sustained decomposition due to contamination or exposure to heat.

Class 2. An oxidizer that will cause a moderate increase in the burning rate or that causes spontaneous ignition of combustible materials with which it comes in contact.

Class 1. An oxidizer whose primary hazard is that it slightly increases the burning rate but which does not cause spontaneous ignition when it comes in contact with combustible materials.

OXIDIZING GAS. A gas that can support and accelerate combustion of other materials.

PHYSICAL HAZARD. A chemical for which there is evidence that it is a combustible liquid, compressed gas, cryogenic, explosive, flammable gas, flammable liquid, flammable solid, organic peroxide, oxidizer, pyrophoric or unstable (reactive) or water-reactive material.

PYROPHORIC. A chemical with an autoignition temperature in air, at or below a temperature of 130°F (54.4°C).

PYROTECHNIC COMPOSITION. A chemical mixture that produces visible light displays or sounds through a self-propagating, heat-releasing chemical reaction which is initiated by ignition.

TOXIC. A chemical falling within any of the following categories:

1. A chemical that has a median lethal dose (LD50) of more than 50 milligrams per kilogram, but not more than 500 milligrams per kilogram of body weight when administered orally to albino rats weighing between 200 and 300 grams each.
2. A chemical that has a median lethal dose (LD50) of more than 200 milligrams per kilogram but not more than 1,000 milligrams per kilogram of body weight when administered by continuous contact for 24 hours (or less if death occurs within 24 hours) with the bare skin of albino rabbits weighing between 2 and 3 kilograms each.
3. A chemical that has a median lethal concentration (LC50) in air of more than 200 parts per million but not more than 2,000 parts per million by volume of gas or vapor, or more than 2 milligrams per liter but not more than 20 milligrams per liter of mist, fume or dust, when administered by continuous inhalation for one hour (or less if death occurs within one hour) to albino rats weighing between 200 and 300 grams each.

UNSTABLE (REACTIVE) MATERIAL. A material, other than an explosive, which in the pure state or as commercially produced, will vigorously polymerize, decompose, condense or become self-reactive and undergo other violent chemical changes, including explosion, when exposed to heat, friction or shock, or in the absence of an inhibitor, or in the presence of contaminants, or in contact with incompatible materials. Unstable (reactive) materials are subdivided as follows:

Class 4. Materials that in themselves are readily capable of detonation or explosive decomposition or explosive reaction at normal temperatures and pressures. This class includes materials that are sensitive to mechanical or localized thermal shock at normal temperatures and pressures.

Class 3. Materials that in themselves are capable of detonation or of explosive decomposition or explosive reaction but which require a strong initiating source or which must be heated under confinement before initiation. This class includes materials that are sensitive to thermal or mechanical shock at elevated temperatures and pressures.

Class 2. Materials that in themselves are normally unstable and readily undergo violent chemical change but do not detonate. This class includes materials that can undergo chemical change with rapid release of energy at normal temperatures and pressures, and that can undergo violent chemical change at elevated temperatures and pressures.

Class 1. Materials that in themselves are normally stable but which can become unstable at elevated temperatures and pressure.

WATER-REACTIVE MATERIAL. A material that explodes; violently reacts; produces flammable, toxic or other hazardous gases; or evolves enough heat to cause self-ignition or ignition of nearby combustibles upon exposure to water or moisture. Water-reactive materials are subdivided as follows:

Class 3. Materials that react explosively with water without requiring heat or confinement.

Class 2. Materials that may form potentially explosive mixtures with water.

Class 1. Materials that may react with water with some release of energy, but not violently.

[F] 307.3 High-Hazard Group H-1. Buildings and structures containing materials that pose a detonation hazard shall be classified as Group H-1. Such materials shall include, but not be limited to, the following:

(1) Explosives:
  (a) Division 1.1
  (b) Division 1.2
  (c) Division 1.3
    Exception: Materials that are used and maintained in a form where either confinement or configuration will not elevate the hazard from a mass fire to mass explosion hazard shall be allowed in H-2 occupancies.
  (d) Division 1.4
    Exception: Articles, including articles packaged for shipment, that are not regulated as an explosive under Bureau of Alcohol, Tobacco and Firearms regulations, or unpackaged articles used in process operations that do not propagate a detonation or deflagration between articles shall be allowed in H-3 occupancies.
  (e) Division 1.5
  (f) Division 1.6
(2) Organic peroxides, unclassified detonable
(3) Oxidizers, Class 4
(4) Unstable (reactive) materials, Class 3 detonable and Class 4
(5) Detonable pyrophoric materials

[F] 307.4 High-Hazard Group H-2. Buildings and structures containing materials that pose a deflagration hazard or a hazard from accelerated burning shall be classified as Group H-2. Such materials shall include, but not be limited to, the following:

(1) Class I, II or IIIA flammable or combustible liquids which are used or stored in normally open containers or systems, or in closed containers or systems pressurized at more than 15 psi (103.4 kPa) gage.
(2) Combustible dusts
(3) Cryogenic fluids, flammable
(4) Flammable gases
(5) Organic peroxides, Class I
(6) Oxidizers, Class 3, that are used or stored in normally open containers or systems, or in closed containers or systems pressurized at more than 15 psi (103.3 kPa) gage
(7) Pyrophoric liquids, solids and gases, nondetonable
(8) Unstable (reactive) materials, Class 3, nondetonable
(9) Water-reactive materials, Class 3

[F] 307.5 High-Hazard Group H-3. Buildings and structures containing materials that readily support combustion or that pose a physical hazard shall be classified as Group H-3. Such materials shall include, but not be limited to, the following:

(1) Class I, II or IIIA flammable or combustible liquids whichare used or stored in normally closed containers or systemspressurized at less than 15 psi (103.4 kPa) gage.
(2) Combustible fibers
(3) Consumer fireworks, 1.4G (Class C Common)
(4) Cryogenic fluids, oxidizing
(5) Flammable solids
(6) Organic peroxides, Classes II and III
(7) Oxidizers, Classes 1 and 2
(8) Oxidizing gases
(9) Unstable (reactive) materials, Class 2
(10) Water-reactive materials, Class 2

[F] 307.6 High-Hazard Group H-4. Buildings and structures which contain materials that are health hazards shall be classified as Group H-4. Such materials shall include, but not be limited to, the following:

(1) Corrosives
(2) Highly toxic materials
(3) Toxic materials

[F] 307.7 Group H-5 Structures. Semiconductor fabrication facilities and comparable research and development areas in which hazardous production materials (HPM) are used and the aggregate quantity of materials is in excess of those listed in Tables 307.7(1) and 307.7(2). Such facilities and areas shall be designed and constructed in accordance with 780 CMR 415.9.

[F] 307.8 Multiple Hazards. Buildings and structures containing a material or materials representing hazards that are classified in one or more of Groups H-1, H-2, H-3 and H-4 shall conform to the code requirements for each of the occupancies so classified.

[F] 307.9 Exceptions: The following shall not be classified in Group H, but shall be classified in the occupancy that they most nearly resemble. Hazardous materials in any quantity shall conform to the requirements of 780 CMR, including 780 CMR 414, the requirements of the International Fire Code and with the requirements of the Massachusetts Board of Fire Prevention Regulations (527 CMR).

1. Buildings and structures that contain not more than the maximum allowable quantities per control area of hazardous materials as shown in Tables 307.7(1) and 307.7(2) provided that such buildings are maintained in accordance with the Massachusetts Board of Fire Prevention Regulations (527 CMR).

2. Buildings utilizing control areas in accordance with 780 CMR 414.2 that contain not more than the maximum allowable quantities per control area of hazardous materials as shown in Tables 307.7(1) and 307.7(2).

3. Buildings and structures occupied for the application of flammable finishes, provided that such buildings or areas conform to the requirements of 780 CMR 416, the requirements of the International Fire Code and with the requirements of the Massachusetts Board of Fire Prevention Regulations (527 CMR).

4. Wholesale and retail sales and storage of flammable and combustible liquids in mercantile occupancies conforming to the International Fire Code and the requirements of the Massachusetts Board of Fire Prevention Regulations (527 CMR).

5. Closed systems housing flammable or combustible liquids or gases utilized for the operation of machinery or equipment.

6. Cleaning establishments that utilize combustible liquid solvents having a flash point of 140°F (60°C) or higher in closed systems employing equipment listed by an approved testing agency, provided that this occupancy is separated from all other areas of the building by 1-hour fire-resistance-rated fire barrier walls or horizontal assemblies or both.

7. Cleaning establishments which utilize a liquid solvent having a flash point at or above 200°F (93°C).

8. Liquor stores and distributors without bulk storage.

9. Refrigeration systems.

10. The storage or utilization of materials for agricultural purposes on the premises.

11. Stationary batteries utilized for facility emergency power, uninterrupted power supply or telecommunication facilities provided that the batteries are provided with safety venting caps and ventilation is provided in accordance with the *International Mechanical Code*.

12. Corrosives shall not include personal or household products in their original packaging used in retail display or commonly used building materials.

13. Buildings and structures occupied for aerosol storage shall be classified as Group S-1, provided that such buildings conform to the requirements of the International Fire Code and with the requirements of the Massachusetts Board of Fire Prevention Regulations (527 CMR).

14. Display and storage of nonflammable solid and nonflammable or noncombustible liquid hazardous materials in quantities not exceeding the maximum allowable quantity per control area in Group M or S occupancies complying with 780 CMR 414.2.4.

15. The storage of black powder, smokeless propellant and small arms primers in Groups M and R-3 and special industrial explosive devices in Groups B, F, M and S, provided such storage conforms to the quantity limits and requirements prescribed in the requirements of the Massachusetts Board of Fire Prevention Regulations (527 CMR).

780 CMR 308.0 INSTITUTIONAL GROUP I

308.1 Institutional Group I. Institutional Group I occupancy includes, among others, the use of a building or structure, or a portion thereof, in which people are cared for or live in a supervised environment, having physical limitations because of health or age are harbored for medical treatment or other care or treatment, or in which people are detained for penal or correctional purposes or in which the liberty of the occupants is restricted. Institutional occupancies shall be classified as Group I-1, I-2, I-3 or I-4.

308.2 Group I-1. Except as modified by the provisions of 780 CMR 4.00, Specialized Detailed Requirements Based on Use and Occupancy, this

occupancy shall include buildings, structures or parts thereof housing more than 16 persons, on a 24-hour basis, who because of age, mental disability or other reasons, live in a supervised residential environment that provides personal care services. The occupants are capable of responding to an emergency situation without physical assistance from staff, except as modified by the provisions of 780 CMR 4.00, Specialized Detailed Requirements Based on Use and Occupancy. This group shall include, but not be limited to, the following:

(1) Residential board and care facilities
(2) Halfway houses
(3) Group homes except as otherwise identified
(4) Congregate care facilities
(5) Social rehabilitation facilities
(6) Alcohol and drug centers
(7) Convalescent facilities

Except as modified by the provisions of 780 CMR 4.00, Specialized Detailed Requirements Based on Use and Occupancy, a facility such as the above with five or fewer persons shall otherwise be classified as a Residential Use Group and appropriately classified, in accordance with 780 CMR.

308.3 Group I-2. Except as modified by the provisions of 780 CMR Chapter 4, Specialized Detailed Requirements Based on Use and Occupancy, this occupancy shall include buildings and structures used for medical, surgical, psychiatric, nursing or custodial care on a 24-hour basis of more than five persons who are not capable of self-preservation. This group shall include, but not be limited to, the following:

(1) Hospitals
(2) Nursing homes (both intermediate-care facilities and skilled nursing facilities)
(3) Mental hospitals
(4) Detoxification facilities

Except as modified by the provisions of 780 CMR 4.00, Specialized Detailed Requirements Based on Use and Occupancy, a facility such as the above with five or fewer persons shall be classified as a Residential Use Group and appropriately classified, in accordance with 780 CMR.

308.3.1 Child Care Facility. A child care facility (not a Day Care Center) that provides care on a 24-hour basis to more than five children two years and nine months of age or less shall be classified as Group I-2. Note however, that the express Special Use and Occupancy requirements of 780 CMR 422.0, for Day Care Center occupancies shall override the general requirements and limitations of E and I USE

308.4 Group I-3. This occupancy shall include buildings and structures that are inhabited by more than five persons who are under restraint or security. An I-3 facility is occupied by persons who are generally incapable of self-preservation due to security measures not under the occupants' control. This group shall include, but not be limited to, the following:

(1) Prisons
(2) Jails
(3) Reformatories
(4) Detention centers
(5) Correctional centers
(6) Prerelease centers

Buildings of Group I-3 shall be classified as one of the occupancy conditions indicated in 780 CMR 308.4.1 through 308.4.5 (*See* 780 CMR 408.1).

308.4.1 Condition 1. This occupancy condition shall include buildings in which free movement is allowed from sleeping areas, and other spaces where access or occupancy is permitted, to the exterior via means of egress without restraint. A Condition 1 facility is permitted to be constructed as Group R.

308.4.2 Condition 2. This occupancy condition shall include buildings in which free movement is allowed from sleeping areas and any other occupied smoke compartment to one or more other smoke compartments. Egress to the exterior is impeded by locked exits.

308.4.3 Condition 3. This occupancy condition shall include buildings in which free movement is allowed within individual smoke compartments, such as within a residential unit comprised of individual sleeping units and group activity spaces, where egress is impeded by remote-controlled release of means of egress from such a smoke compartment to another smoke compartment.

308.4.4 Condition 4. This occupancy condition shall include buildings in which free movement is restricted from an occupied space. Remote-controlled release is provided to permit movement from sleeping units, activity spaces and other occupied areas within the smoke compartment to other smoke compartments.

308.4.5 Condition 5. This occupancy condition shall include buildings in which free movement is restricted from an occupied space. Staff-controlled manual release is provided to permit movement from sleeping units, activity spaces and other occupied areas within the smoke compartment to other smoke compartments.

308.5 Group I-4, Day Care Center. This group shall include buildings and structures occupied by persons of two years none months or younger who receive custodial care for less than 24 hours by individuals other than parents or guardians, relatives by blood, marriage or adoption, and in a place other than the home of the person cared for. Places of worship during religious functions are not included. ***Note, that the express Special Use and Occupancy requirements of 780 CMR 422.0, for***

Day care occupancies shall override the general requirements and limitations of E and I USE.

308.5.1 Adult Care Facility. A facility that provides accommodations for less than 24 hours for more than five unrelated adults and provides supervision and personal care services shall be classified as Group I-4.

Exception: A facility where occupants are capable of responding to an emergency situation and evacuating in no more than three minutes, without direct physical assistance from the staff, shall be classified as Group A-3.

308.5.2 Child Day Care Facility. A facility that provides supervision and personal care on less than a 24-hour basis for children two years and nine months of age or less shall be classified as Group I-4.

780 CMR 309.0 MERCANTILE GROUP M

309.1 Mercantile Group M. Mercantile Group M occupancy includes, among others, buildings and structures or a portion thereof, for the display and sale of merchandise, and involves stocks of goods, wares or merchandise incidental to such purposes and accessible to the public. Mercantile occupancies shall include, but not be limited to, the following:

(1) Department stores
(2) Drug stores
(3) Markets
(4) Motor fuel-dispensing facilities
(5) Retail or wholesale stores
(6) Sales rooms

309.2 Quantity of Hazardous Materials. The aggregate quantity of nonflammable solid and nonflammable or noncombustible liquid hazardous materials stored or displayed in a single control area of a Group M occupancy shall not exceed the quantities in Table 414.2.4.

Note: also see 780 CMR 424.0 for Bulk Merchandising Retail Buildings.

780 CMR 310.0 RESIDENTIAL GROUP R

310.1 Residential Group R. Residential Group R includes, among others, the use of a building or structure, or a portion thereof, for sleeping purposes when not classified as an Institutional Group I. Residential occupancies shall include the following (also *see* 780 CMR 310.1: General Note):

(1) **R-1** Residential occupancies where the occupants are primarily transient in nature, including:

(a) Boarding houses (transient)
(b) Hotels (transient)
(c) Motels (transient)

(2) **R-2** Residential occupancies containing sleeping units or more than two dwelling units where the occupants are primarily permanent in nature, including:

(a) Apartment houses
(b) Boarding houses (not transient)
(c) Convents
(d) Dormitories
(e) Fraternities and sororities
(f) Monasteries
(g) Vacation timeshare properties
(h) Hotels (nontransient)
(i) Motels (nontransient)

(3) ***R-3 Residential occupancies where the occupants are primarily permanent in nature and not classified as R-1, R-2, R-4 or I and where buildings do not contain more than two dwelling units as applicable in 780 CMR 101.2, or are adult and child care facilities that provide accommodations for five or fewer persons of any age for less than 24 hours. Adult and child care facilities within a single-family home that are not otherwise controlled by the Day Care or various Group home requirements of 780 CMR 4.00, are permitted to comply with 780 CMR 51.00 through 99.00: Massachusetts Building Code for One- and Two-Family Dwellings, 7th Edition*** (plus Referenced Standards, Regulations, Appendices and Index) *in accordance with 780 CMR 101.2.*

(4) ***R-4 Residential occupancies shall include buildings arranged for occupancy as residential care including more than five but not more than 16 occupants, excluding staff.*** *Group R-4 occupancies shall meet the requirements for construction as defined for Group R-3 except as otherwise provided for in 780 CMR (i.e., seismic provisions of 780 CMR are imposed on other than one- and two-family houses, etc.).*

General Note: Pursuant to M.G.L. c. 19D, Assisted Living Residences which are certified as such by the Executive Office of Elder Affairs, shall be classified in the residential use group R-1, R-2, R-3, or R-4 as applicable. For Building Code purposes, however, portions of Assisted Living Residences which are used for any use other than residential shall be classified and designed and constructed in accordance with the intended use.

310.2 Definitions. The following words and terms shall, for the purposes of 780 CMR 310.0 and as used elsewhere in 780 CMR, have the meanings shown in 780CMR 310.2

ASSISTED LIVING RESIDENCE. A residence certified by the Executive Office of Elder Affairs pursuant to M.G.L. c. 19D

BOARDING HOUSE. A building arranged or used for lodging for compensation, with or without meals, and not occupied as a single-family unit.

DORMITORY. A space in a building where group sleeping accommodations are provided in one room, or in a series of closely associated rooms, for persons not members of the same family group, under joint occupancy and single management, as in college dormitories or fraternity houses.

DWELLING UNIT. A single unit providing complete, independent living facilities for one or more persons, including permanent provisions for living, sleeping, eating, cooking and sanitation.

PERSONAL CARE SERVICE. The care of residents who do not require chronic or convalescent medical or nursing care. Personal care involves responsibility for the safety of the resident while inside the building.

RESIDENTIAL CARE. *A building or part thereof housing persons, on a 24-hour basis, who because of age, mental disability or other reasons, live in a supervised residential environment which provides personal care services. The occupants are capable of responding to an emergency situation without physical assistance from staff. This classification shall include, but not be limited to, the following: residential board and care facilities, halfway houses, group homes, congregate care facilities, social rehabilitation facilities, alcohol and drug abuse centers and convalescent facilities. Also refer to governing regulations of 780 CMR 4.00, Special Detailed Requirements Based on Use and Occupancy.*

780 CMR 311.0 STORAGE GROUP S

311.1 Storage Group S. Storage Group S occupancy includes, among others, the use of a building or structure, or a portion thereof, for storage that is not classified as a hazardous occupancy.

311.2 Moderate-hazard Storage, Group S-1. Buildings occupied for storage uses which are not classified as Group S-2 including, but not limited to, storage of the following:

(1) Aerosols, Levels 2 and 3
(2) Aircraft repair hangar
(3) Bags; cloth, burlap and paper
(4) Bamboos and rattan
(5) Baskets
(6) Belting; canvas and leather
(7) Books and paper in rolls or packs
(8) Boots and shoes
(9) Buttons, including cloth covered, pearl or bone
(10) Cardboard and cardboard boxes
(11) Clothing, woolen wearing apparel
(12) Cordage
(13) Furniture
(14) Furs
(15) Glues, mucilage, pastes and size
(16) Grains
(17) Horns and combs, other than celluloid
(18) Leather
(19) Linoleum
(20) Lumber
(21) Motor vehicle repair garages complying with the maximum allowable quantities of hazardous materials listed in Table 307.7(1) (*See* 780 CMR 406.6)
(22) Photo engravings
(23) Resilient flooring
(24) Silks
(25) Soaps
(26) Sugar
(27) Tires, bulk storage of
(28) Tobacco, cigars, cigarettes and snuff
(29) Upholstery and mattresses
(30) Wax candles

311.3 Low-hazard Storage, Group S-2. Includes, among others, buildings used for the storage of noncombustible materials such as products on wood pallets or in paper cartons with or without single thickness divisions; or in paper wrappings. Such products are permitted to have a negligible amount of plastic trim, such as knobs, handles or film wrapping. Storage uses shall include, but not be limited to, storage of the following:

(1) Aircraft hangar
(2) Asbestos
(3) Beverages up to and including 12-percent alcohol in metal, glass or ceramic containers
(4) Cement in bags
(5) Chalk and crayons
(6) Dairy products in nonwaxed coated paper containers
(7) Dry cell batteries
(8) Electrical coils
(9) Electrical motors
(10) Empty cans
(11) Food products
(12) Foods in noncombustible containers
(13) Fresh fruits and vegetables in nonplastic trays or containers
(14) Frozen foods
(15) Glass
(16) Glass bottles, empty or filled with noncombustible liquids
(17) Gypsum board
(18) Inert pigments
(19) Ivory
(20) Meats
(21) Metal cabinets
(22) Metal desks with plastic tops and trim
(23) Metal parts
(24) Metals
(25) Mirrors
(26) Oil-filled and other types of distribution transformers
(27) Parking garages, open or enclosed
(28) Porcelain and pottery
(29) Stoves
(30) Talc and soapstones
(31) Washers and dryers

780 CMR 312.0 UTILITY AND MISCELLANEOUS GROUP U

312.1 General. Buildings and structures of an accessory character and miscellaneous structures not classified in any specific occupancy shall be constructed, equipped and maintained to conform to the requirements of 780 CMR commensurate with the fire and life hazard incidental to their occupancy. Group U shall include, but not be limited to, the following:

(1) Agricultural buildings
(2) Aircraft hangars, accessory to a one- or two-family residence (*See* 780 CMR 412.3)
(3) Barns
(4) Carports
(5) Fences more than six feet (1829 mm) high
(6) Grain silos, accessory to a residential occupancy
(7) Greenhouses
(8) Livestock shelters
(9) Private garages
(10) Retaining walls
(11) Sheds
(12) Stables
(13) Tanks
(14) Towers

NON-TEXT PAGE

780 CMR 4.00
SPECIAL DETAILED REQUIREMENTS BASED ON USE AND OCCUPANCY

780 CMR 401.0 SCOPE

401.1 Detailed Use and Occupancy Requirements. In addition to the occupancy and construction requirements in 780 CMR, the provisions of 780 CMR 4.00 apply to the special uses and occupancies described in 780 CMR and where requirements of 780 CMR 4.00 and general requirements of 780 CMR exist, the specific requirements of 780 CMR 4.00, as applicable, shall apply.

Applicable Massachusetts General Law and Requirements of the Specialized Codes. Applicable Massachusetts General Laws, and applicable rules and regulations of the Specialized Codes (see 780 CMR 101.2) shall be adhered to in the design and construction of building and structures subject to the provisions of 780 CMR 4.00 – note that rules and regulations of the Specialized Codes are not enforced by Building officials (Building Officials do, however, enforce requirements of 521 CMR).

The ICC International Fire Code (IFC), the ICC International Mechanical Code (IMC) and the Specific Specialized Code - The Board of Fire Prevention Regulations (527 CMR). 780 CMR contains design and construction requirements for all USE Group buildings and their building permittable systems and also references additional applicable design and construction requirements of the IFC and the IMC for the various USE Groups and industrial processes within such USE Groups, including H-USES. It is the intention in referencing the IFC and the IMC that only the IFC and IMC requirements narrow to Building Code matters; i.e., USE Group classification, general building limitations of height and area, fireresistant materials and construction, interior finishes, required fire protection systems (otherwise not specifically regulated by 527 CMR), means of egress, interior environment, energy conservation, exterior wall coverings, roof and roof coverings, structural loads, structural tests and inspections, foundations and retaining walls, construction materials, glass and glazing, plastics, mechanical systems, special construction, site work, demolition and construction in the public right-of-way, building permittable work in existing buildings and control of manufactured buildings and manufactured components, etc., as historically addressed in the Massachusetts State Building Code are intended regulated by 780 CMR.

> *Exception: The design and construction requirements of bunkers and magazines for the storage of explosive materials, flammable/combustible liquids and chemical process safety, shall default to the specific requirements of 527 CMR and are not enforceable by Building Officials but rather by the Head of the Fire Department or his/her designee.*
>
> *Note that the IFC and the IMC are not only building and building permittable systems design and construction documents but also include fire prevention requirements and the fire prevention requirements of the IFC and IMC are not requirements regulated by 780 CMR nor enforceable by Building Officials. For fire prevention requirements do not refer to the IFC or IMC but rather to The Massachusetts Board of Fire Prevention Regulations (527 CMR). If there is conflict between 780 CMR and 527 CMR, the more stringent standard shall apply.*

401.3 The ICC International Fire Code (IFC), the ICC International Mechanical Code (IMC) and the Family of Massachusetts Specialized Codes (refer to 780 CMR 101.5). 780 CMR contains design and construction requirements for all USE Group buildings and their building permittable systems and also references additional applicable design and construction requirements of the IFC and the IMC for the various USE Groups and industrial processes within such USE Groups, including H-USES. It is the intention in referencing the IFC and the IMC that only the IFC and IMC requirements narrow to Building Code matters (see 780 CMR 301.1.1 are regulated by 780 CMR. Where the IFC and IMC reference requirements related to: architectural access; environmental protection; electrical; elevator; fire prevention (otherwise not specifically regulated by 527 CMR); gas; or sanitary code requirements, such requirements are not regulated by 780 CMR nor enforceable by Building Officials (Building Officials do enforce architectural access requirements set forth in 521 CMR). For Specialized Code requirements do not refer to the IFC or IMC but rather to the appropriate Specialized Code requirements of Massachusetts (refer to 780 CMR 101.5).

780 CMR 402.0 COVERED MALL BUILDINGS

402.1 Scope. The provisions of 780 CMR 402.0 shall apply to buildings or structures defined in 780 CMR 402.2 as covered mall buildings not exceeding three floor levels at any point nor more than three stories above grade. Except as specifically required by 780 CMR 402.0, covered mall buildings shall meet applicable provisions of 780 CMR.

Exceptions:

1. Foyers and lobbies of Groups B, R-1 and R-2 are not required to comply with 780 CMR 402.0.
2. Buildings need not comply with the provisions of 780 CMR 402.0 where they totally comply with other applicable provisions of 780 CMR.

402.2 Definitions. The following words and terms shall, for the purposes of 780 CMR 4.00 and as used elsewhere in 780 CMR, have the meanings shown 780 CMR 402.2.

ANCHOR BUILDING. An exterior perimeter building of a group other than H having direct access to a covered mall building but having required means of egress independent of the mall.

COVERED MALL BUILDING. A single building enclosing a number of tenants and occupants such as retail stores, drinking and dining establishments, entertainment and amusement facilities, passenger transportation terminals, offices, and other similar uses wherein two or more tenants have a main entrance into one or more malls. For the purpose of 780 CMR 4.00, anchor buildings shall not be considered as a part of the covered mall building.

FOOD COURT. A public seating area located in the mall that serves adjacent food preparation tenant spaces.

GROSS LEASABLE AREA. The total floor area designed for tenant occupancy and exclusive use. The area of tenant occupancy is measured from the centerlines of joint partitions to the outside of the tenant walls. All tenant areas, including areas used for storage, shall be included in calculating gross leasable area.

MALL. A roofed or covered common pedestrian area within a covered mall building that serves as access for two or more tenants and not to exceed three levels that are open to each other.

402.3 Lease Plan. Each covered mall building owner shall provide both the building and fire departments with a lease plan showing the location of each occupancy and its exits after the certificate of occupancy has been issued. No modifications or changes in occupancy or use shall be made from that shown on the lease plan without prior approval of the building official.

402.4 Means of Egress. Each tenant space and the covered mall building shall be provided with means of egress as required by 780 CMR 402.0 and 780 CMR. Where there is a conflict between the requirements of 780 CMR and the requirements of 780 CMR 402.0, the requirements of 780 CMR 402.0 shall apply.

402.4.1 Determination of Occupant Load. The occupant load permitted in any individual tenant space in a covered mall building shall be determined as required by 780 CMR. Means of egress requirements for individual tenant spaces shall be based on the occupant load thus determined.

402.4.1.1 Occupant Formula. In determining required means of egress of the mall, the number of occupants for whom means of egress are to be provided shall be based on gross leasable area of the covered mall building (excluding anchor buildings) and the occupant load factor as determined by the following equation.

Equation 4-1

$$OLF = (0.00007)(GLA) + 25$$

where:

OLF= The occupant load factor (square feet per person).

GLA= The gross leasable area (square feet).

402.4.1.2 OLF Range. The occupant load factor (OLF) is not required to be less than 30 and shall not exceed 50.

402.4.1.3 Anchor Buildings. The occupant load of anchor buildings opening into the mall shall not be included in computing the total number of occupants for the mall.

402.4.1.4 Food Courts. The occupant load of a food court shall be determined in accordance with 780 CMR 1004.0. For the purposes of determining the means of egress requirements for the mall, the food court occupant load shall be added to the occupant load of the covered mall building as calculated above.

402.4.2 Number of Means of Egress. Wherever the distance of travel to the mall from any location within a tenant space used by persons other than employees exceeds 75 feet (22 860 mm) or the tenant space exceeds an occupant load of 50, not less than two means of egress shall be provided.

402.4.3 Arrangements of Means of Egress. Assembly occupancies with an occupant load of 500 or more shall be so located in the covered mall building that their entrance will be immediately adjacent to a principal entrance to the mall and shall have not less than one-half of their required means of egress opening directly to the exterior of the covered mall building.

402.4.3.1 Anchor Building Means of Egress. Required means of egress for anchor buildings shall be provided independently from the mall means of egress system. The occupant load of anchor buildings opening into the mall shall not be included in determining means of egress requirements for the mall. The path of egress travel of malls shall not exit through anchor buildings. Malls terminating at an anchor building where no other means of egress has been provided shall be considered as a dead-end mall.

402.4.4 Distance to Exits. Within each individual tenant space in a covered mall building, the maximum distance of travel from any point to an exit or entrance to the mall shall not exceed 200 feet (60 960 mm).

The maximum distance of travel from any point within a mall to an exit shall not exceed 200 feet (60 960 mm).

402.4.5 Access to Exits. Where more than one exit is required, they shall be so arranged that it is possible to travel in either direction from any point in a mall to separate exits. The minimum width of an exit passageway or corridor from a mall shall be 66 inches (1676 mm).

Exception: Dead ends not exceeding a length equal to twice the width of the mall measured at the narrowest location within the dead-end portion of the mall.

402.4.5.1 Exit Passageway Enclosures. Where exit passageway enclosures provide a secondary means of egress from a tenant space, doors to the exit passageway enclosures shall be one-hour fire doors. Such doors shall be self-closing and be so maintained or shall be automatic-closing by smoke detection.

402.4.6 Service Areas Fronting on Exit Passageways. Mechanical rooms, electrical rooms, building service areas and service elevators are permitted to open directly into exit passageways provided that the exit passageway is separated from such rooms with one-hour fire-resistance-rated walls and one-hour opening protectives.

402.5 Mall Width. For the purpose of providing required egress, malls are permitted to be considered as corridors but need not comply with the requirements of 780 CMR 1005.1 where the width of the mall is as specified in 780 CMR 402.0.

402.5.1 Minimum Width. The minimum width of the mall shall be 20 feet (6096 mm). The mall width shall be sufficient to accommodate the occupant load served. There shall be a minimum of ten feet (3048 mm) clear exit width to a height of eight feet (2438 mm) between any projection of a tenant space bordering the mall and the nearest kiosk, vending machine, bench, display opening, food court or other obstruction to means of egress travel.

402.6 Types of Construction. The area of any covered mall building, including anchor buildings, of Type I, II, III and IV construction, shall not be limited provided the covered mall building and attached anchor buildings and parking garages are surrounded on all sides by a permanent open space of not less than 60 feet (18 288 mm) and the anchor buildings do not exceed three stories in height. The allowable height and area of anchor buildings greater than three stores in height shall comply with 780 CMR 503.0, as modified by 780 CMR 504.0 and 506.0. The construction type of open parking garages and enclosed parking garages shall comply with 780 CMR 406.3 and 406.4, respectively.

402.7 Fire-resistance-rated Separation. Fire-resistance-rated separation is not required between tenant spaces and the mall. Fire-resistance-rated separation is not required between a food court and adjacent tenant spaces or the mall.

402.7.1 Attached Garage. An attached garage for the storage of passenger vehicles having a capacity of not more than nine persons and open parking garages shall be considered as a separate building where it is separated from the covered mall building by a fire barrier having a fire-resistance rating of at least two hours.

Exception: Where an open parking garage or enclosed parking garage is separated from the covered mall building or anchor building a distance greater than ten feet (3048 mm), the provisions of Table 602 shall apply. Pedestrian walkways and tunnels which attach the open parking garage or enclosed parking garage to the covered mall building or anchor building shall be constructed in accordance with 780 CMR 3104.0.

402.7.2 Tenant Separations. Each tenant space shall be separated from other tenant spaces by a fire partition complying with 780 CMR 708.0. A tenant separation wall is not required between any tenant space and the mall.

402.7.3 Anchor Building Separation. An anchor building shall be separated from the covered mall building by fire walls complying with 780 CMR 706.0.

Exception: Anchor buildings of not more than three stories above grade which have an occupancy classification of the same uses permitted as tenants of the covered mall building shall be separated by two-hour fire resistive fire-barriers complying with 780 CMR 705.0.

402.7.3.1 Openings Between Anchor Building and Mall. Except for the separation between Group R-1 sleeping units and the mall, openings between anchor buildings of Type IA, IB, IIA and IIB construction and the mall need not be protected.

[F] 402.8 Automatic Sprinkler System. The covered mall building and buildings connected shall be provided throughout with an automatic sprinkler system in accordance with 780 CMR 903.3.1.1, which shall comply with the following:

1. The automatic sprinkler system shall be complete and operative throughout occupied space in the covered mall building prior to occupancy of any of the tenant spaces. Unoccupied tenant

spaces shall be similarly protected unless provided with approved alternate protection.

2. Sprinkler protection for the mall shall be independent from that provided for tenant spaces or anchors. Where tenant spaces are supplied by the same system, they shall be independently controlled.

Exception: An automatic sprinkler system shall not be required in spaces or areas of open parking garages constructed in accordance with 780 CMR 406.2.

402.8.1 Standpipe System. The covered mall building shall be equipped throughout with a standpipe system as required by 780 CMR 905.3.3.

402.9 Smoke Control. A smoke control system shall be provided where required for atriums in 780 CMR 404.

402.10 Kiosks. Kiosks and similar structures (temporary or permanent) shall meet the following requirements:

1. Combustible kiosks or other structures shall not be located within the mall unless constructed of any of the following materials:
   1.1. Fire-retardant-treated wood complying with 780 CMR 2303.10.
   1.2. Foam plastics having a maximum heat release rate not greater than 100kW (105 Btu/h) when tested in accordance with the exhibit booth protocol in UL 1975.
   1.3. Aluminum composite material (ACM) having a flame spread index of not more than 25 and a smoke-developed index of not more than 450 when tested as an assembly in the maximum thickness intended for use in accordance with ASTM E 84.
2. Kiosks or similar structures located within the mall shall be provided with approved fire suppression and detection devices.
3. The minimum horizontal separation between kiosks or groupings thereof and other structures within the mall shall be 20 feet (6096 mm).
4. Each kiosk or similar structure or groupings thereof shall have a maximum area of 300 square feet (28 m^2).
5. A permit is required from the Head of the Fire Department

402.11 Security Grilles and Doors. Horizontal sliding or vertical security grilles or doors that are a part of a required means of egress shall conform to the following:

1. They shall remain in the full open position during the period of occupancy by the general public.
2. Doors or grilles shall not be brought to the closed position when there are more than 10 persons occupying spaces served by a single exit or 50 persons occupying spaces served by more than one exit.
3. The doors or grilles shall be openable from within without the use of any special knowledge or effort where the space is occupied.
4. Where two or more exits are required, not more than one-half of the exits shall be permitted to include either a horizontal sliding or vertical rolling grille or doors.

402.12 Standby Power. Covered mall buildings exceeding 50,000 square feet (4645 m^2) shall be provided with standby power systems that are capable of operating the emergency voice/alarm communication system. *See* 527 CMR 12.00 for additional requirements.

[F] 402.13 Emergency Voice/Alarm Communication System. Covered mall buildings exceeding 50,000 square feet (4645 m^2) in total floor area shall be provided with an emergency voice/ alarm communication system. Emergency voice/ alarm communication systems serving a mall, required or otherwise, shall be accessible to the fire department. The system shall be provided in accordance with 780 CMR 907.2.12.2.

402.14 Plastic Signs. Within every store or level and from sidewall to sidewall of each tenant space facing the mall, plastic signs shall be limited as specified in 780 CMR 402.14.1 through 402.14.5.

402.14.1 Area. Plastic signs shall not exceed 20% of the wall area facing the mall.

402.14.2 Height and Width. Plastic signs shall not exceed a height of 36 inches (914 mm), except if the sign is vertical, the height shall not exceed 96 inches (2438 mm) and the width shall not exceed 36 inches (914 mm).

402.14.3 Location. Plastic signs shall be located a minimum distance of 18 inches (457 mm) from adjacent tenants.

402.14.4 Plastics Other than Foam Plastics. Plastics other than foam plastics used in signs shall be light-transmitting plastics complying with 780 CMR 2606.4 or shall have a self-ignition temperature of 650°F (343°C) or greater when tested in accordance with ASTM D 1929, and a flame spread index not greater than 75 and smoke-developed index not greater than 450 when tested in the manner intended for use in accordance with ASTM E 84 or meet the acceptance criteria of 780 CMR 803.2.1 when tested in accordance with NFPA 286.

402.14.4.1 Encasement. Edges and backs of plastic signs in the mall shall be fully encased in metal.

402.14.5 Foam Plastics. Foam plastics used in signs shall have flame-retardant characteristics such that the sign has a maximum heat-release rate of 150 kilowatts when tested in accordance with UL 1975 and the foam plastics shall have the physical characteristics specified in 780 CMR 402.0. Foam plastics used in signs installed in accordance with 780 CMR 402.14 shall not be required to comply with the flame spread and smoke-developed indexes specified in 780 CMR 2603.3.

402.14.5.1 Density. The minimum density of foam plastics used in signs shall not be less than 20 pounds per cubic foot (pcf) (320 kg/M^3).

402.14.5.2 Thickness. The thickness of foam plastic signs shall not be greater than ½-inch (12.7 mm).

402.15 Fire Department Access to Equipment. Rooms or areas containing controls for air-conditioning systems, automatic fire-extinguishing systems or other detection, suppression or control elements shall be identified for use by the fire department.

780 CMR 403.0 HIGH-RISE BUILDINGS

403.1 Applicability. The provisions of 780 CMR 403.0 shall apply to all buildings more than 70 feet in height above the mean grade (note that the requirement for automatic sprinklers, in accordance with the requirements of the 780 CMR, in high rise buildings – buildings and structures of more than 70 feet in height - is dictated by M.G.L. c. 148, § 26A).

Exception: The provisions of 780 CMR 403.0 shall not apply to the following buildings and structures:

1. Airport traffic control towers in accordance with 780 CMR 412.0.
2. Open parking garages in accordance with 780 CMR 406.3.
3. Buildings with an occupancy in Group A-5 in accordance with 780 CMR 303.1.
4. Low-hazard special industrial occupancies in accordance with 780 CMR 503.1.2.
5. Buildings with an occupancy in Group H-1, H-2 or H-3 in accordance with 780 CMR 415.

[F] 403.2 Automatic Sprinkler System. Buildings and structures shall be equipped throughout with an automatic sprinkler system in accordance with 780 CMR 903.3.1.1 and a secondary water supply where required by 780 CMR 903.3.5.2.

403.3 Reduction in Fire-resistance Rating. The fire-resistance-rating reductions listed in 780 CMR 403.3.1 and 403.3.2 shall be allowed in buildings that have sprinkler control valves equipped with supervisory initiating devices and water-flow initiating devices for each floor.

403.3.1 Type of Construction. The following reductions in the minimum construction type allowed in Table 601 shall be allowed as provided in 780 CMR 403.3:

1. Type IA construction shall be allowed to be reduced to Type IB.
2. In other than Groups F-1, M and S-1, Type IB construction shall be allowed to be reduced to Type IIA.
3. The height and area limitations of the reduced construction type shall be allowed to be the same as for the original construction type.

403.3.2 Shaft Enclosures. The required fire-resistance rating of the fire barrier walls enclosing vertical shafts, other than exit enclosures and elevator hoistway enclosures, shall be reduced to one hour where automatic sprinklers are installed within the shafts at the top and at alternate floor levels.

403.4 Emergency Escape and Rescue. Emergency escape and rescue openings required by 780 CMR 1025.0 are not required.

[F] 403.5 Automatic Fire Detection. Smoke detection shall be provided in accordance with 780 CMR 907.2.12.1.

[F] 403.6 Emergency Voice/Alarm Communication Systems. An emergency voice/alarm communication system shall be provided in accordance with 780 CMR 907.2.12.2.

[F] 403.7 Fire Department Communications System. A two-way fire department communications system shall be provided for fire department use in accordance with 780 CMR 907.2.12.3.

[F] 403.8 Fire Command. A fire command center complying with 780 CMR 911.0 shall be provided in a location approved by the fire department.

403.9 Elevators. Elevator operation and installation shall be in accordance with 524 CMR. Elevator service shall be provided to all floors. Elevator cab dimensions shall conform to the applicable requirements of 524 CMR. Except for the main entrance level, all elevators shall open into a lobby separated from the remainder of the building by one hour fire resistance rated construction in accordance with 780 CMR 707.14.

Exit stairways, chutes, janitor closets, tenant spaces in Use Group R and service rooms shall not open into the elevator lobby. In Use Groups other than R, tenant spaces opening into the elevator lobby shall be provided with other means of exit access that do not require passage through the elevator lobby

403.10 Standby Power. A standby power system complying with 527 CMR 12.00: The Massachusetts Electrical Code, NFPA 110 and NFPA 111, as applicable, shall be provided for standby power loads specified in 780 CMR 403.10.2.

403.10.1 Special Requirements for Standby Power Systems. If the standby system is a generator set inside a building, the system shall be located in a separate room enclosed with two-hour fire-resistance-rated fire barrier assemblies. System supervision with manual start and transfer features shall be provided at the fire command center. *See* 527 CMR 12.00 for additional requirements.

403.10.2 Standby Power Loads. The following are classified as standby power loads:

1. Power and lighting for the fire command center required by 780 CMR 403.8;
2. Electrically powered fire pumps;
3. Ventilation and automatic fire detection equipment for smokeproof enclosures.

Standby power shall be provided for elevators when required by the State Elevator Code (524 CMR).

403.11 Emergency Power Systems. An emergency power system complying with 527 CMR 12:00: The Massachusetts Electrical Code, NFPA 110 and NFPA 111, as applicable, shall be provided for emergency power loads specified in 780 CMR 403.11.1.

403.11.1 Emergency Power Loads. The following are classified as emergency power loads:

1. *Exit signs and means of egress illumination required by 780 CMR 10.00;*
2. *Elevator car lighting (see 524 CMR);*
3. Emergency voice/alarm communications systems;
4. Automatic fire detection systems; and
5. Fire alarm systems.

403.12 Stairway Door Operation. Stairway doors other than the exit discharge doors shall be permitted to be locked from stairway side. Stairway doors that are locked from the stairway side shall be capable of being unlocked simultaneously without unlatching upon a signal from the fire command center.

403.12.1 Stairway Communications System. A telephone or other two-way communications system connected to an approved constantly attended station shall be provided at not less than every fifth floor in each required stairway where the doors to the stairway are locked.

403.13 Smokeproof Exit Enclosures. Every required stairway serving floors more than 70 feet (22 860 mm) in height shall comply as follows: A smokeproof enclosure, as set forth in 780 CMR 909.20 is required for at least one exit. Other required stairways greater than 70 feet in height shall be pressurized to a minimum of 0.15 inches of water column, but not exceeding 0.35 inches of water column. Such required stairway pressurization being relative to building pressure and with all stairway doors closed. Pressurization design shall take into consideration maximum anticipated stack pressure effects in the stairway. The stairway pressurization system shall be activated by any devices which are required to activate the voice alarm system described in 780 CMR 403.5.

403.14 Seismic Considerations. For seismic considerations, *see* 780 CMR 16.00.

780 CMR 404.0 ATRIUMS

404.1 General. Vertical openings meeting the requirements of 780 CMR 404.0 are not required to be enclosed in other than Group H occupancies.

404.1.1 Definition. The following word and term shall, for the purposes of 780 CMR 4.00 and as used elsewhere in 780 CMR, have the meaning shown in 780 CMR 404.1.1.

ATRIUM. An opening connecting two or more stories other than enclosed stairways, elevators, hoistways, escalators, plumbing, electrical, air-conditioning or other equipment, which is closed at the top and not defined as a mall. Stories, as used in this definition, do not include balconies within assembly groups or mezzanines that comply with 780 CMR 505.0.

404.2 Use. The floor of the atrium shall not be used for other than low fire hazard uses and only approved materials and decorations in accordance with the Board of Fire Prevention Regulations Fire Prevention Regulations (527 CMR) are allowed.

Exception: The atrium floor area is permitted to be used for any approved use where the individual space is provided with an automatic sprinkler system in accordance with 780 CMR 903.3.1.1.

[F] 404.3 Automatic Sprinkler Protection. An approved automatic sprinkler system shall be installed throughout the entire building.

Exceptions:

1. That area of a building adjacent to or above the atrium need not be sprinklered provided that portion of the building is separated from the atrium portion by a two-hour fire-resistance-rated fire barrier wall or horizontal assembly or both.
2. Where the ceiling of the atrium is more than 55 feet (16 764 mm) above the floor, sprinkler protection at the ceiling of the atrium is not required.

404.4 Smoke Control. A smoke control system shall be installed in accordance with 780 CMR 909.0.

Exceptions:

1. Smoke control is not required for floor openings meeting the requirements of 780 CMR 707.2, Exception 2., 7., 8. or 9.
2. Smoke control is not required for floor openings meeting the requirements of 780 CMR 1019.1, Exception 8. or 9.

404.5 Enclosure of Atriums. Atrium spaces shall be separated from adjacent spaces by a one-hour fire barrier wall.

Exceptions:

1. A glass wall forming a smoke partition where automatic sprinklers are spaced six feet (1829 mm) or less along both sides of the separation wall, or on the room side only if there is not a walkway on the atrium side, and between four inches and 12 inches (102 mm and 305 mm) away from the glass and so designed that the entire surface of the glass is wet upon activation of the sprinkler system. The glass shall be installed in a gasketed frame so that the framing system deflects without breaking (loading) the glass before the sprinkler system operates.
2. A glass-block wall assembly in accordance with 780 CMR 21.00 (ACI 530) and having a ¾-hour fire protection rating.
3. The adjacent spaces of any three floors of the atrium shall not be required to be separated from the atrium where such spaces are included in computing the atrium volume for the design of the smoke control system.

***404.6 Standby Power.** Equipment required to provide smoke control shall be connected to a standby power system in accordance with 780 CMR 909.11, NFPA 110 and/or NFPA 111 and installed in accordance with 527 CMR 12.00: The Massachusetts Electrical Code.*

404.7 Interior Finish. The interior finish of walls and ceilings of the atrium shall not be less than Class B with no reduction in class for sprinkler protection.

404.8 Travel Distance. In other than the lowest level of the atrium, where the required means of egress is through the atrium space, the portion of exit access travel distance within the atrium space shall not exceed 200 feet (60 960 mm).

780 CMR 405.0 UNDERGROUND BUILDINGS

405.1 General. The provisions of 782 CMR 405.0 apply to building spaces having a floor level used for human occupancy more than 30 feet (9144 mm) below the lowest level of exit discharge.

Exceptions:

1. One- and two-family dwellings, sprinklered in accordance with 780 CMR 903.3.1.3.
2. Parking garages with automatic fire suppression systems in compliance with 780 CMR 405.3.
3. Fixed guideway transit systems.
4. Grandstands, bleachers, stadiums, arenas and similar facilities.
5. Where the lowest story is the only story that would qualify the building as an underground building and has an area not exceeding 1,500 square feet (139 m^2) and has an occupant load less than ten.

405.2 Construction Requirements. The underground portion of the building shall be of Type I construction.

[F] 405.3 Automatic Sprinkler System. The highest level of exit discharge serving the underground portions of the building and all levels below shall be equipped with an automatic sprinkler system installed in accordance with 780 CMR 903.3.1.1. Water-flow switches and control valves shall be supervised in accordance with 780 CMR 903.4.

405.4 Compartmentation. Compartmentation shall be in accordance with 780 CMR 405.4.1 through 405.4.3.

405.4.1 Number of Compartments. A building having a floor level more than 60 feet (18 288 mm) below the lowest level of exit discharge shall be divided into a minimum of two compartments of approximately equal size. Such compartmentation shall extend through the highest level of exit discharge serving the underground portions of the building and all levels below.

Exception: The lowest story need not be compartmented where the area does not exceed 1,500 square feet (139 m^2) and has an occupant load of less than ten.

405.4.2 Smoke Barrier Penetration. The separation between the two compartments shall be of minimum one-hour fire barrier wall construction that shall extend from floor slab to floor deck above. Openings between the two compartments shall be limited to plumbing and electrical piping and conduit penetrations firestopped in accordance with 780 CMR 712.0. Doorways shall be protected by fire door assemblies that are automatic-closing by smoke detection in accordance with 780 CMR 715.0 as applicable and shall be provided with gasketing and a drop sill to minimize smoke leakage. Where provided, each compartment shall have an air supply and an exhaust system independent of the other compartments.

405.4.3 Elevators. Where elevators are provided, each compartment shall have direct access to an elevator. Where an elevator serves more than one compartment, an elevator lobby shall be provided and shall be separated from each compartment by a one-hour fire barrier wall. Doors shall be gasketed, have a drop sill, and be automatic-closing by smoke detection installed in accordance with 780 CMR 907.10.

405.5 Smoke Control System. A smoke control system shall be provided in accordance with 780 CMR 405.5.1 and 405.5.2.

405.5.1 Control System. A smoke control system is required to control the migration of products of combustion in accordance with 780 CMR 909.0 and the provisions of 780 CMR 405.0. Smoke control shall restrict movement of smoke to the general area of fire origin and maintain means of egress in a usable condition.

405.5.2 Smoke Exhaust System. Where compartmentation is required, each compartment shall have an independent smoke control system. The system shall be automatically activated and capable of manual operation in accordance with 780 CMR 907.2.18.

[F] 405.6 Fire Alarm Systems. A fire alarm system shall be provided where required by 780 CMR 907.2.19.

[F] 405.7 Public Address. A public address system shall be provided where required by 780 CMR 907.2.19.1.

405.8 Means of Egress. Means of egress shall be in accordance with 780 CMR 405.8.1 and 405.8.2.

405.8.1 Number of Exits. Each floor level shall be provided with a minimum of two exits. Where compartmentation is required by 780 CMR 405.4, each compartment shall have a minimum of one exit and shall also have an exit access doorway into the adjoining compartment.

405.8.2 Smokeproof Enclosure. Every required stairway serving floor levels more than 30 feet (9144 mm) below its level of exit discharge shall comply with the requirements for a smokeproof enclosure as provided in 780 CMR 1019.1.8.

[F] 405.9 Standby Power. A standby power system complying with NFPA-110 and/or NFPA 111 and installed in accordance with 527 CMR 12.00: The Massachusetts Electrical Code, shall provide standby power loads for that equipment specified in 780 CMR 405.9.1.

405.9.1 Standby Power Loads. The following loads are classified as standby power loads.

1. *Smoke control system.*
2. *Ventilation and automatic fire detection equipment for smokeproof enclosures.*
3. *Fire pumps.*

Standby power shall be provided for elevators when required by the Massachusetts Elevator Code (524 CMR).

405.9.2 Pick-up Time. The standby power system shall pick up its connected loads within 60 seconds of failure of the normal power supply and electrical connection shall be in accordance with NFPA-110, NFPA-111 and 527 CMR 12.00.

[F] 405.10 Emergency Power. An emergency power system complying with NFPA-110 or NFPA-111, as applicable and electrically connected in accordance with 527 CMR 12.00 shall be provided for emergency power loads specified in 780 CMR 405.10.1.

405.10.1 Emergency Power Loads. The following loads are classified as emergency power loads:

1. Emergency voice/alarm communications systems.
2. Fire alarm systems.
3. Automatic fire detection systems.
4. ***Elevator car lighting (see 524 CMR).***
5. Means of egress and exit sign illumination as required by 780 CMR 10.00.

405.11 Standpipe System. The underground building shall be provided throughout with a standpipe system in accordance with 780 CMR 905.0.

780 CMR 406.0 MOTOR-VEHICLE-RELATED OCCUPANCIES

406.1 Private Garages and Carports.

406.1.1 Classification. Buildings or parts of buildings classified as Group U occupancies because of the use or character of the occupancy shall not exceed 1,000 square feet (93 m^2) in area or one story in height except as provided in 780 CMR 406.1.2. Any building or portion thereof that exceeds the limitations specified in 780 CMR 406.0 shall be classified in the occupancy group other than Group U that it most nearly resembles.

406.1.2 Area Increase. Group U occupancies used for the storage of private or pleasure-type motor vehicles where no repair work is done or fuel dispensed are permitted to be 3,000 square feet (279 m^2), when the following provisions are met:

1. For a mixed occupancy building, the exterior wall and opening protection for the Group U portion of the building shall be as required for the major occupancy of the building. For such mixed occupancy building, the allowable floor area of the building shall be as permitted for the major occupancy contained therein.
2. For a building containing only a Group U occupancy, the exterior wall and opening protection shall be as required for a Group R-1 or R-2 occupancy.

More than one 3,000-square-foot (279 m^2) Group U occupancy shall be permitted to be in the same building, provided each 3,000-square-foot (279 m^2) area is separated by fire walls complying with 780 CMR 705.0.

406.1.3 Garages and Carports. Carports shall be open on at least two sides. Carport floor surfaces shall be of approved noncombustible material. Carports not open on at least two sides shall be considered a garage and shall comply with the provisions of 780 CMR 406.0 for garages.

Exception. Asphalt surfaces shall be permitted at ground level in carports.

The area of floor used for parking of automobiles or other vehicles shall be sloped to facilitate the movement of liquids to a drain or toward the main vehicle entry doorway.

406.1.4 Separation. Separations shall comply with the following:

1. The private garage shall be separated from the dwelling unit and its attic area by means of a minimum ½-inch (12.7 mm) gypsum board applied to the garage side. Garages beneath habitable rooms shall be separated from all habitable rooms above by not less than ⅝-inch Type X gypsum board or equivalent. Door openings between a private garage and the dwelling unit shall be equipped with either solid wood doors, or solid or honeycomb core steel doors not less than 1⅜ inches (34.9 mm) thick, or doors in compliance with 780 CMR 715.3.3. Openings from a private garage directly into a room used for sleeping purposes shall not be permitted.
2. Ducts in a private garage and ducts penetrating the walls or ceilings separating the dwelling unit from the garage shall be constructed of a minimum 0.019-inch (0.48 mm) sheet steel and shall have no openings into the garage.
3. A separation is not required between a Group R-3 and U carport provided the carport is entirely open on two or more sides and there are not enclosed areas above.

406.2 Parking Garages.

406.2.1 Classification. Parking garages shall be classified as either open, as defined in 780 CMR 406.3, or enclosed and shall meet the appropriate criteria in 780 CMR 406.4. Also see 780 CMR 508.0 for special provisions for parking garages.

406.2.2 Clear Height. The clear height of each floor level in vehicle and pedestrian traffic areas shall not be less than seven feet (2134 mm). Vehicle and pedestrian areas accommodating van-accessible parking required by 780 CMR 11.00 shall conform to 521 CMR, as applicable.

406.2.3 Guards. Guards shall be provided in accordance with 780 CMR 1012 at exterior and interior vertical openings on floor and roof areas where vehicles are parked or moved and where the vertical distance to the ground or surface directly below exceeds 30 inches (762 mm).

406.2.4 Vehicle Barriers. Parking areas shall be provided with exterior or interior walls or vehicle barriers, except at pedestrian or vehicular accesses, designed in accordance with 780 CMR 1607.7. Vehicle barriers not less than two feet (607 mm) high shall be placed at the ends of drive lanes, at the end of parking spaces where the difference in adjacent floor elevation is greater than one foot (305 mm).

406.2.5 Ramps. Vehicle ramps shall not serve as an exit element.

406.2.6 Floor Surface. Parking surfaces shall be of concrete or similar noncombustible and nonabsorbent materials.

> **Exception**. Asphalt parking surfaces are permitted at ground level.

The area of floor used for parking of automobiles or other vehicles shall be sloped to facilitate the movement of liquids to a drain or toward the main vehicle entry doorway.

406.2.7 Mixed Separation. Parking garages shall be separated from other occupancies in accordance with 780 CMR 302.3.2.

406.2.8 Special Hazards. Connection of a parking garage with any room in which there is a fuel-fired appliance shall be by means of a vestibule providing a two-doorway separation.

Exception: A single door shall be allowed provided the sources of ignition in the appliance are at least 18 inches (457 mm) above the floor.

406.2.9 Attached to Rooms. Openings from a parking garage directly into a room used for sleeping purposes shall not be permitted.

406.3 Open Parking Garages.

406.3.1 Scope. Except where specific provisions are made in 780 CMR 406.3.2 through 406.3.13, other requirements of 780 CMR shall apply.

406.3.2 Definitions. The following words and terms shall, for the purposes of 780 CMR 4.00 and as used elsewhere in 780 CMR, have the meanings shown 780 CMR 406.3.2.

MECHANICAL-ACCESS OPEN PARKING GARAGES. Open parking garages employing parking machines, lifts, elevators or other mechanical devices for vehicles moving from and to street level and in which public occupancy is prohibited above the street level.

OPEN PARKING GARAGE. A structure or portion of a structure with the openings as described in 780 CMR 406.3.3.1 on two or more sides that is used for the parking or storage of private motor vehicles as described in 780 CMR 406.3.4.

RAMP-ACCESS OPEN PARKING GARAGES. Open parking garages employing a series of continuously rising floors or a series of interconnecting ramps between floors permitting the movement of vehicles under their own power from and to the street level.

406.3.3 Construction. Open parking garages shall be of Type I, II or IV construction. Open parking garages shall meet the design requirements of 780 CMR 16.00. For vehicle barriers, *see* 780 CMR 406.2.4.

406.3.3.1 Openings. For natural ventilation purposes, the exterior side of the structure shall have uniformly distributed openings on two or more sides. The area of such openings in exterior walls on a tier must be at least 20% of the total perimeter wall area of each tier. The aggregate length of the openings considered to be providing natural ventilation shall constitute a minimum of 40% of the perimeter of the tier. Interior walls shall be at least 20% open with uniformly distributed openings.

Exception: Openings are not required to be distributed over 40% of the building perimeter where the required openings are uniformly distributed over two opposing sides of the building.

406.3.4 Uses. Mixed uses shall be allowed in the same building as an open parking garage subject to the provisions of 780 CMR 302.3, 402.7.1, 406.3.13, 508.3.2, 508.3, 508.4 and 508.7.

406.3.5 Area and Height. Area and height of open parking garages shall be limited as set forth in 780 CMR 5.00 for Group S-2 occupancies and as further provided for in 780 CMR 302.3.

406.3.5.1 Single Use. When the open parking garage is used exclusively for the parking or storage of private motor vehicles, with no other uses in the building, the area and height shall be permitted to comply with Table 406.3.5, along with increases allowed by 780 CMR 406.3.6.

Exception. The grade-level tier is permitted to contain an office, waiting and toilet rooms having a total combined area of not more than 1,000 square feet (93 m^2). Such area need not be separated from the open parking garage.

In open parking garages having a spiral or sloping floor, the horizontal projection of the structure at any cross section shall not exceed the allowable area per parking tier. In the case of an open parking garage having a continuous spiral floor, each nine feet six inches (2896 mm) of height, or portion thereof, shall be considered a tier.

The clear height of a parking tier shall not be less than seven feet (2134 mm), except that a lower clear height is permitted in mechanical-access open parking garages where approved by the building official.

TABLE 406.3.5 OPEN PARKING GARAGES AREA AND HEIGHT

TYPE OF CONSTRUCTION	AREA PER TIER (square feet)	HEIGHT (in tiers)		
		Ramp access	Mechanical access	
			Automatic sprinkler system	
			No	Yes
IA	Unlimited	Unlimited	Unlimited	Unlimited
IB	Unlimited	12 tiers	12 tiers	18 tiers
IIA	50,000	10 tiers	10 tiers	15 tiers
IIB	50,000	8 tiers	8 tiers	12 tiers
IV	50,000	4 tiers	4 tiers	4 tiers

For SI: 1 square foot = 0.0929 m^2

406.3.6 Area and Height Increases. The allowable area and height of open parking garages shall be increased in accordance with the provisions of 780 CMR 406.0. Garages with sides open on three-fourths of the building perimeter are permitted to be increased by 25% in area and one tier in height. Garages with sides open around the entire building perimeter are permitted to be increased 50% in area and one tier in height. For a side to be considered open under the above provisions, the total area of openings along the side shall not be less than 50% of the interior area of the side at each tier, and such openings shall be equally distributed along the length of the tier.

Allowable tier areas in Table 406.3.5 shall be increased for open parking garages constructed to heights less than the table maximum. The gross tier area of the garage shall not exceed that permitted for the higher structure. At least three sides of each such larger tier shall have continuous horizontal openings not less than 30 inches (762 mm) in clear height extending for at least 80% of the length of the sides, and no part of such larger tier shall be more than 200 feet (60 960 mm) horizontally from such an opening. In addition, each such opening shall face a street or yard accessible to a street with a width of at least 30 feet (9144 mm) for the full length of the opening, and standpipes shall be provided in each such tier.

Open parking garages of Type IB and II construction, with all sides open, shall be unlimited in allowable area where the height does not exceed 75 feet (22 860 mm). For a side to be considered open, the total area of openings along the side shall not be less than 50% of the interior area of the side at each tier, and such openings shall be equally distributed along the length of the tier. All portions of tiers shall be within 200 feet (60 960 mm) horizontally from such openings.

406.3.7 Location on Property. Exterior walls and openings in exterior walls shall comply with Tables 601 and 602. The distance from an adjacent lot line shall be determined in accordance with Table 602 and 780 CMR 704.

406.3.8 Means of Egress. Where persons other than parking attendants are permitted, open parking garages shall meet the means of egress requirements of 780 CMR 10.00. Where no persons other than parking attendants are permitted, there shall not be less than two 36-inch-wide (914 mm) exit stairways. Lifts shall be permitted to be installed for use of employees only, provided they are completely enclosed by noncombustible materials.

406.3.9 Standpipes. Standpipes shall be installed where required by the provisions of 780 CMR 9.00.

406.3.10 Sprinkler Systems. Where required by other provisions or 780 CMR, automatic sprinkler systems and standpipes shall be installed in accordance with the provisions of 780 CMR 9.00.

406.3.11 Enclosure of Vertical Openings. Enclosure shall not be required for vertical openings except as specified in 780 CMR 406.3.8.

406.3.12 Ventilation. Ventilation, other than the percentage of openings specified in 780 CMR 406.3.3.1, shall not be required.

406.3.13 Prohibitions. The following uses and alterations are not permitted:

1. Vehicle repair work.
2. Parking of buses, trucks and similar vehicles.
3. Partial or complete closing of required openings in exterior walls by tarpaulins or any other means.
4. Dispensing of fuel.

406.4 Enclosed Parking Garages.

406.4.1 Heights and Areas. Enclosed vehicle parking garages and portions thereof that do not meet the definition of open parking garages shall be limited to the allowable heights and areas specified in Table 503. Roof parking is permitted.

406.4.2 Ventilation. A mechanical ventilation system shall be provided in accordance with the *International Mechanical Code*.

406.5 Motor Fuel-dispensing Facilities. See 527 CMR for additional requirements.

406.5.1 Construction. Motor fuel-dispensing facilities shall be constructed in accordance with the *International Fire Code* and 780 CMR 406.0.

406.5.2 Canopies. Canopies under which fuels are dispensed shall have a clear, unobstructed height of not less than 13 feet six inches (4115 mm) to the lowest projecting element in the vehicle drive-through area. Canopies and their supports over pumps shall be of noncombustible materials, fire-retardant-treated wood complying with 780 CMR 23.00, wood of Type IV sizes or of construction providing one-hour fire resistance. Combustible materials used in or on a canopy shall comply with one of the following:

1. Shielded from the pumps by a noncombustible element of the canopy, or wood of Type IV sizes;
2. Plastics covered by aluminum facing having a minimum thickness of 0.010 inch (0.30 mm) or corrosion-resistant steel having a minimum base metal thickness of 0.016 inch (0.41 mm). The plastic shall have a flame spread index of 25 or less and a smoke-developed index of 450 or less when tested in the form intended for use in accordance with ASTM E 84 and a self-ignition temperature of 650°F (343°C) or greater when tested in accordance with ASTM D 1929; or

3. Panels constructed of light-transmitting plastic materials shall be permitted to be installed in canopies erected over motor vehicle fuel-dispensing station fuel dispensers, provided the panels are located at least 10 feet (3048 mm) from any building on the same property and face yards or streets not less than 40 feet (12 192 mm) in width on the other sides. The aggregate areas of plastics shall not exceed 1,000 square feet (93 m^2). The maximum area of any individual panel shall not exceed 100 square feet (9.3 m^2).

406.6 Repair Garages.

406.6.1 General. Repair garages shall be constructed in accordance with the *International Fire Code* and 780 CMR 406.0 (Note that the Fire Prevention Regulations of Massachusetts at 527 CMR apply). This occupancy shall not include motor fuel-dispensing facilities, as regulated in 780 CMR 406.5.

406.6.2 Mixed Uses. Mixed uses shall be allowed in the same building as a repair garage subject to the provisions of 780 CMR 302.3.

406.6.3 Ventilation. Repair garages shall be mechanically ventilated in accordance with the *International Mechanical Code*. The ventilation system shall be controlled at the entrance to the garage.

406.6.4 Floor Surface. Repair garage floors shall be of concrete or similar noncombustible and nonabsorbent materials.

Exception. Slip-resistant, nonabsorbent, interior floor finishes having a critical radiant flux not more than 0.45 W/cm2, as determined by NFPA 253, shall be permitted.

406.6.5 Heating Equipment. Heating equipment shall be installed in accordance with the *International Mechanical Code*.

[F] 406.6.6 Gas Detection System. Repair garages used for repair of vehicles fueled by nonodorized gases, such as hydrogen and nonodorized LNG, shall be provided with an approved flammable gas-detection system.

[F] 406.6.6.1 System Design. The flammable gas-detection system shall be calibrated to the types of fuels or gases used by vehicles to be repaired. The gas detection system shall be designed to activate when the level of flammable gas exceeds 25% of the lower explosive limit. Gas detection shall also be provided in lubrication or chassis repair pits of garages used for repairing nonodorized LNG-fueled vehicles.

[F] 406.6.6.2 Operation. Activation of the gas detection system shall result in all of the following:

1. Initiation of distinct audible and visual alarm signals in the repair garage.
2. Deactivation of all heating systems located in the repair garage.
3. Activation of the mechanical ventilation system, where the system is interlocked with gas detection.

[F] 406.6.6.3 Failure of the Gas Detection System. Failure of the gas detection system shall result in the deactivation of the heating system, activation of the mechanical ventilation system when the system is interlocked with the gas detection system and cause a trouble signal to sound in an approved location.

780 CMR 407.0 GROUP I-2

407.1 General. Occupancies in Group I-2 shall comply with the provisions of 780 CMR 407.0 and other applicable provisions of 780 CMR.

Note: Hospitals, nursing homes and convalescent homes shall be constructed of Type 1 construction in accordance with M.G.L. c. 111, §§ 51 and 71.

407.2 Corridors. Corridors in occupancies in Group I-2 shall be continuous to the exits and separated from other areas in accordance with 780 CMR 407.3 except spaces conforming to 780 CMR 407.2.1 through 407.2.4.

407.2.1 Spaces of Unlimited Area. Waiting areas and similar spaces constructed as required for corridors shall be permitted to be open to a corridor, only where all of the following criteria are met:

1. The spaces are not occupied for patient sleeping units, treatment rooms, hazardous or incidental use areas as defined in 780 CMR 302.1.1.
2. The open space is protected by an automatic fire detection system installed in accordance with 780 CMR 907.
3. The corridors onto which the spaces open, in the same smoke compartment, are protected by an automatic fire detection system installed in accordance with 780 CMR 907, or the smoke compartment in which the spaces are located is equipped throughout with quick-response sprinklers in accordance with 780 CMR 903.3.2.
4. The space is arranged so as not to obstruct access to the required exits.

407.2.2 Nurses' Stations. Spaces for doctors' and nurses' charting, communications and related clerical areas shall be permitted to be open to the corridor, when such spaces are constructed as required for corridors.

407.2.3 Mental Health Treatment Areas. Areas wherein mental health patients who are not capable of self-preservation are housed, or group meeting or multipurpose therapeutic spaces other than incidental use areas as defined in 780 CMR 302.1.1, under continuous supervision by facility staff, shall be permitted to be open to the corridor, where the following criteria are met:

1. Each area does not exceed 1,500 square feet (140 m^2).
2. The area is located to permit supervision by the facility staff.
3. The area is arranged so as not to obstruct any access to the required exits.
4. The area is equipped with an automatic fire detection system installed in accordance with 780 CMR 907.2.
5. Not more than one such space is permitted in any one smoke compartment.
6. The walls and ceilings of the space are constructed as required for corridors.

407.2.4 Gift Shops. Gift shops less than 500 square feet (46.5 m^2) in area shall be permitted to be open to the corridor provided the gift shop and storage areas are fully sprinklered and storage areas are protected in accordance with 780 CMR 302.1.1.

407.3 Corridor Walls. Corridor walls shall be constructed as smoke partitions.

407.3.1 Corridor Doors. Corridor doors, other than those in a wall required to be rated by 780 CMR 302.1.1 or for the enclosure of a vertical opening or an exit, shall not have a required fire protection rating and shall not be required to be equipped with self-closing or automatic-closing devices, but shall provide an effective barrier to limit the transfer of smoke and shall be equipped with positive latching. Roller latches are not permitted. Other doors shall conform to 780 CMR 715.3.

407.3.2 Locking Devices. Locking devices that restrict access to the patient room from the corridor, and that are operable only by staff from the corridor side, shall not restrict the means of egress from the patient room except for patient rooms in mental health facilities.

407.4 Smoke Barriers. Smoke barriers shall be provided to subdivide every story used by patients for sleeping or treatment and to divide other stories with an occupant load of 50 or more persons, into at least two smoke compartments. Such stories shall be divided into smoke compartments with an area of not more than 22,500 square feet (2092 m^2) and the travel distance from any point in a smoke compartment to a smoke barrier door shall not exceed 200 feet (60 960 mm). The smoke barrier shall be in accordance with 780 CMR 709.

407.4.1 Refuge Area. At least 30 net square feet (2.8 m^2) per patient shall be provided within the aggregate area of corridors, patient rooms, treatment rooms, lounge or dining areas and other low-hazard areas on each side of each smoke barrier. On floors not housing patients confined to a bed or litter, at least six net square feet (0.56 m^2) per occupant shall be provided on each side of each smoke barrier for the total number of occupants in adjoining smoke compartments.

407.4.2 Independent Egress. A means of egress shall be provided from each smoke compartment created by smoke barriers without having to return through the smoke compartment from which means of egress originated.

[F] 407.5 Automatic Sprinkler System. Smoke compartments containing patient sleeping units shall be equipped throughout with an automatic fire sprinkler system in accordance with 780 CMR 903.3.1.1. The smoke compartments shall be equipped with approved quick-response or residential sprinklers in accordance with 780 CMR 903.3.2.

407.6 Automatic Fire Detection. Corridors in nursing homes (both intermediate-care and skilled nursing facilities), detoxification facilities and spaces permitted to be open to corridors by 780 CMR 407.2 shall be protected by an automatic fire detection system installed in accordance with 780 CMR 907.0.

Exceptions:

1. Corridor smoke detection is not required where patient sleeping units are provided with smoke detectors that comply with UL 268. Such detectors shall provide a visual display on the corridor side of each patient sleeping unit and an audible and visual alarm at the nursing station attending each unit.
2. Corridor smoke detection is not required where patient sleeping unit doors are equipped with automatic door-closing devices with integral smoke detectors on the unit sides installed in accordance with their listing, provided that the integral detectors perform the required alerting function.

407.7 Secured Yards. Grounds are permitted to be fenced and gates therein are permitted to be equipped with locks, provided that safe dispersal areas having 30 net square feet (2.8 m^2) for bed and litter patients and six net square feet (0.56 m^2) for ambulatory patients and other occupants are located between the building and the fence. Such provided safe dispersal areas shall not be located less than 50 feet (15 240 mm) from the building they serve.

780 CMR 408.0 GROUP I-3

408.1 General. Occupancies in Group I-3 shall comply with the provisions of 780 CMR 408.0 and other applicable provisions of 780 CMR (*see* 780 CMR 308.4).

Note: Refer to 527 CMR for additional requirements.

408.1.1 Sallyports. A sallyport is a security vestibule with two or more doors where the intended purpose is to prevent continuous and unobstructed passage by allowing the release of only one door at a time.

408.2 Mixed Occupancies. Portions of buildings with an occupancy in Group I-3 that are classified as a different occupancy shall meet the applicable requirements of 780 CMR for such occupancies. Where security operations necessitate the locking of required means of egress, provisions shall be made for the release of occupants at all times.

Means of egress from detention and correctional occupancies that traverse other use areas shall, as a minimum, conform to requirements for detention and correctional occupancies.

Exception. It is permissible to exit through a horizontal exit into other contiguous occupancies that do not conform to detention and correctional occupancy egress provisions but that do comply with requirements set forth in the appropriate occupancy, as long as the occupancy is not a high-hazard use.

408.3 Means of Egress. Except as modified or as provided for in 780 CMR 408.0, the provisions of 780 CMR 10.00 shall apply.

408.3.1 Door Width. Doors to resident sleeping units shall have a clear width of not less than 28 inches (711 mm).

408.3.2 Sliding Doors. Where doors in a means of egress are of the horizontal-sliding type, the force to slide the door to its fully open position shall not exceed 50 pounds (220 N) with a perpendicular force against the door of 50 pounds (220 N).

408.3.3 Spiral Stairs. Spiral stairs that conform to the requirements of 780 CMR 1009.9 are permitted for access to and between staff locations.

408.3.4 Exit Discharge. Exits are permitted to discharge into a fenced or walled courtyard. Enclosed yards or courts shall be of a size to accommodate all occupants, a minimum of 50 feet (15 240 mm) from the building with a net area of 15 square feet (1.4 m^2) per person.

408.3.5 Sallyports. A sallyport shall be permitted in a means of egress where there are provisions for continuous and unobstructed passage through the sallyport during an emergency egress condition.

408.3.6 Vertical Exit Enclosures. One of the required vertical exit enclosures in each building shall be permitted to have glazing installed in doors and interior walls at each landing level providing access to the enclosure, provided that the following conditions are met:

1. The vertical exit enclosure shall not serve more than four floor levels.
2. Vertical exit enclosure doors shall not be less than ¾-hour fire doors complying with 780 CMR 715.3.
3. The total area of glazing at each floor level shall not exceed 5,000 square inches (3.23 m^2) and individual panels of glazing shall not exceed 1,296 square inches (0.84 m^2).
4. The glazing shall be protected on both sides by an automatic fire sprinkler system. The sprinkler system shall be designed to wet completely the entire surface of any glazing affected by fire when actuated.
5. The glazing shall be in a gasketed frame and installed in such a manner that the framing system will deflect without breaking (loading) the glass before the sprinkler system operates.
6. Obstructions, such as curtain rods, drapery traverse rods, curtains, drapes or similar materials shall not be installed between the automatic sprinklers and the glazing.

408.4 Locks. Egress doors are permitted to be locked in accordance with the applicable use condition. Doors from an area of refuge to the exterior are permitted to be locked with a key in lieu of locking methods described in 780 CMR 408.4.1. The keys to unlock the exterior doors shall be available at all times and the locks shall be operable from both sides of the door.

408.4.1 Remote Release. Remote release of locks on doors in a means of egress shall be provided with reliable means of operation, remote from the resident living areas, to release locks on all required doors. In Occupancy Conditions 3 or 4, the arrangement, accessibility and security of the release mechanism(s) required for egress shall be such that with the minimum available staff at any time, the lock mechanisms are capable of being released within two minutes.

Exception. Provisions for remote locking and unlocking of occupied rooms in Occupancy Condition 4 are not required provided that not more than ten locks are necessary to be unlocked in order to move occupants from one smoke compartment to a refuge area within three minutes. The opening of necessary locks shall be accomplished with not more than two separate keys.

[F] 408.4.2 Power-operated Doors and Locks. Power-operated sliding doors or power-operated locks for swinging doors shall be operable by a manual release mechanism at the door, and either emergency power or a remote mechanical operating release shall be provided.

Exception. Emergency power is not required in facilities with ten locks or less complying with the exception to 780 CMR 408.4.1.

408.4.3 Redundant Operation. Remote release, mechanically operated sliding doors or remote release, mechanically operated locks shall be provided with a mechanically operated release mechanism at each door, or shall be provided with a redundant remote release control.

408.4.4 Relock Capability. Doors remotely unlocked under emergency conditions shall not automatically relock when closed unless specific action is taken at the remote location to enable doors to relock.

408.5 Vertical Openings. Vertical openings shall be enclosed in accordance with 780 CMR 707.0.

Exception. A floor opening between floor levels of residential housing areas is permitted without enclosure protection between the levels, provided that both of the following conditions are met:

1. The entire normally occupied areas so interconnected are open and unobstructed so as to enable observation of the areas by supervisory personnel.
2. Means of egress capacity is sufficient to provide simultaneous egress for all occupants from all interconnected levels and areas.

The height difference between the highest and lowest finished floor levels shall not exceed 23 feet (7010 mm). Each story, considered separately, has at least one-half of its individual required means of egress capacity provided by exits leading directly out of that story without traversing another story within the interconnected area.

408.6 Smoke Barrier. Occupancies in Group I-3 shall have smoke barriers complying with 780 CMR 709.0 to divide every story occupied by residents for sleeping, or any other story having an occupant load of 50 or more persons, into at least two smoke compartments.

Exception. Spaces having direct exit to one of the following, provided that the locking arrangement of the doors involved complies with the requirements for doors at the compartment barrier for the use condition involved:

1. A public way.
2. A building separated from the resident housing area by a 2-hour fire-resistance-rated assembly or 50 feet (15 240 mm) of open space.
3. A secured yard or court having a holding space 50 feet (15 240 mm) from the housing area that provides 6 square feet (0.56 m^2) or more of refuge area per occupant, including residents, staff and visitors.

408.6.1 Smoke Compartments. The maximum number of residents in any smoke compartment shall be 200. The travel distance to a door in a smoke barrier from any room door required as exit access shall not exceed 150 feet (45 720 mm). The travel distance to a door in a smoke barrier from any point in a room shall not exceed 200 feet (60 960 mm).

408.6.2 Refuge Area. At least six net square feet (0.56 m^2) per occupant shall be provided on each side of each smoke barrier for the total number of occupants in adjoining smoke compartments. This space shall be readily available wherever the occupants are moved across the smoke barrier in a fire emergency.

408.6.3 Independent Egress. A means of egress shall be provided from each smoke compartment created by smoke barriers without having to return through the smoke compartment from which means of egress originates.

408.7 Subdivision of Resident Housing Areas. Sleeping areas and any contiguous day room, group activity space or other common spaces where residents are housed shall be separated from other spaces in accordance with 780 CMR 408.7.1 through 408.7.4.

408.7.1 Occupancy Conditions 3 and 4. Each sleeping area in Occupancy Conditions 3 and 4 shall be separated from the adjacent common spaces by a smoke-tight partition where the travel distance from the sleeping area through the common space to the exit access corridor exceeds 50 feet (15 240 mm).

408.7.2 Occupancy Condition 5. Each sleeping area in Occupancy Condition 5 shall be separated from adjacent sleeping areas, corridors and common spaces by a smoke-tight partition. Additionally, common spaces shall be separated from the exit access corridor by a smoke-tight partition.

408.7.3 Openings in Room Face. The aggregate area of openings in a solid sleeping room face in Occupancy Conditions 2, 3, 4 and 5 shall not exceed 120 square inches (77 419 mm^2). The aggregate area shall include all openings including door undercuts, food passes and grilles. Openings shall be not more than 36 inches (914 mm) above the floor. In Occupancy Condition 5, the openings shall be closeable from the room side.

408.7.4 Smoke-tight Doors. Doors in openings in partitions required to be smoke tight by 780 CMR 408.7 shall be substantial doors, of construction that will resist the passage of smoke. Latches and door closures are not required on cell doors.

408.8 Windowless Buildings. For the purposes of 780 CMR 408.0, a windowless building or portion of a building is one with nonopenable windows, windows not readily breakable or without windows. Windowless buildings shall be provided with an engineered smoke control system to provide ventilation (mechanical or natural) in accordance with 780 CMR 909.0 for each windowless smoke compartment.

780 CMR 409.0 MOTION PICTURE PROJECTION ROOMS

(Refer to M.G.L. c. 143, § 89 for additional information regarding cellulose nitrate film and 780 CMR 100.00 for related Code of Massachusetts Regulations); also see 527 CMR.

409.1 General. The provisions of 780 CMR 409.0 shall apply to rooms in which ribbon-type cellulose acetate or other safety film is utilized in conjunction with electric arc, xenon or other light-source projection equipment that develops hazardous gases, dust or radiation. Where cellulose nitrate film is utilized or stored, such rooms shall comply with NFPA 40.

409.1.1 Projection Room Required. Every motion picture machine projecting film as mentioned within the scope of 780 CMR 409.0 shall be enclosed in a projection room. Appurtenant electrical equipment, such as rheostats, transformers and generators, shall be within the projection room or in an adjacent room of equivalent construction.

409.2 Construction of Projection Rooms. Every projection room shall be of permanent construction consistent with the construction requirements for the type of building in which the projection room is located. Openings are not required to be protected. The room shall have a floor area of not less than 80 square feet (7.44 m^2) for a single machine and at least 40 square feet (3.7 m^2) for each additional machine. Each motion picture projector, floodlight, spotlight or similar piece of equipment shall have a clear working space of not less than 30 inches by 30 inches (762 mm by 762 mm) on each side and at the rear thereof, but only one such space shall be required between two adjacent projectors. The projection room and the rooms appurtenant thereto shall have a ceiling height of not less than seven feet six inches (2286 mm). The aggregate of openings for projection equipment shall not exceed 25% of the area of the wall between the projection room and the auditorium. Openings shall be provided with glass or other approved material, so as to close completely the opening.

409.3 Projection Room and Equipment Ventilation. Ventilation shall be provided in accordance with the *International Mechanical Code*.

409.3.1 Projection Room.

409.3.1.1 Supply Air. Each projection room shall be provided with adequate air supply inlets so arranged as to provide well-distributed air throughout the room. Air inlet ducts shall provide an amount of air equivalent to the amount of air being exhausted by projection equipment. Air is permitted to be taken from the outside; from adjacent spaces within the building, provided the volume and infiltration rate is sufficient; or from the building air-conditioning system, provided it is so arranged as to provide sufficient air when other systems are not in operation.

409.3.1.2 Exhaust Air. Projection rooms are permitted to be exhausted through the lamp exhaust system. The lamp exhaust system shall be positively interconnected with the lamp so that the lamp will not operate unless there is the required airflow. Exhaust air ducts shall terminate at the exterior of the building in such a location that the exhaust air cannot be readily recirculated into any air supply system. The projection room ventilation system is permitted to also serve appurtenant rooms, such as the generator and rewind rooms.

Each projection machine shall be provided with an exhaust duct that will draw air from each lamp and exhaust it directly to the outside of the building. The lamp exhaust is permitted to serve to exhaust air from the projection room to provide room air circulation. Such ducts shall be of rigid materials, except for a flexible connector approved for the purpose. The projection lamp or projection room exhaust system, or both, is permitted to be combined but shall not be interconnected with any other exhaust or return system, or both, within the building.

409.4 Lighting Control. Provisions shall be made for control of the auditorium lighting and the means of egress lighting systems of theaters from inside the projection room and from at least one other convenient point in the building.

409.5 Miscellaneous Equipment. Each projection room shall be provided with rewind and film storage facilities.

780 CMR 410.0 STAGES AND PLATFORMS

410.1 Applicability. The provisions of 780 CMR 410.0 shall apply to all parts of buildings and structures that contain stages or platforms and similar appurtenances as defined im 780 CMR 410.2.

410.2 Definitions. The following words and terms shall, for the purposes of 780 CMR 410.0 and as used elsewhere in 780 CMR, have the meanings shown 780 CMR 410.2.

FLY GALLERY. A raised floor area above a stage from which the movement of scenery and operation of other stage effects are controlled.

GRIDIRON. The structural framing over a stage supporting equipment for hanging or flying scenery and other stage effects.

PINRAIL. A rail on or above a stage through which belaying pins are inserted and to which lines are fastened.

PLATFORM. A raised area within a building used for worship, the presentation of music, plays or other entertainment; the head table for special guests; the raised area for lecturers and speakers; boxing and wrestling rings; theater-in-the-round stages; and similar purposes wherein there are no overhead hanging curtains, drops, scenery or stage effects other than lighting and sound. A temporary platform is one installed for not more than 30 days.

PROSCENIUM WALL. The wall that separates the stage from the auditorium or assembly seating area.

STAGE. A space within a building utilized for entertainment or presentations, which includes overhead hanging curtains, drops, scenery or stage effects other than lighting and sound. Stage area shall be measured to include the entire performance area and adjacent backstage and support areas not separated from the performance area by fire-resistance-rated construction. Stage height shall be measured from the lowest point on the stage floor to the highest point of the roof or floor deck above the stage.

410.3 Stages. Stage construction shall comply with 780 CMR 410.3.1 through 410.3.7.

410.3.1 Stage Construction. Stages shall be constructed of materials as required for floors for the type of construction of the building in which such stages are located.

Exceptions:

1. Stages of Type IIB or IV construction with a nominal two-inch (51 mm) wood deck, provided that the stage is separated from other areas in accordance with 780 CMR 410.3.5.
2. In buildings of Type IIA, IIIA and VA construction, a fire-resistance-rated floor is not required, provided the space below the stage is equipped with an automatic fire-extinguishing system in accordance with 780 CMR 903.0 or 904.0.
3. In all types of construction, the finished floor shall be constructed of wood or approved noncombustible materials. Openings through stage floors shall be equipped with tight-fitting, solid wood trap doors with approved safety locks.

410.3.1.1 Stage Height and Area. Stage areas shall be measured to include the entire performance area and adjacent backstage and support areas not separated from the performance area by fire-resistance-rated construction. Stage height shall be measured from the lowest point on the stage floor to the highest point of the roof or floor deck above the stage.

410.3.2 Galleries, Gridirons, Catwalks and Pinrails. Beams designed only for the attachment of portable or fixed theater equipment, gridirons, galleries and catwalks shall be constructed of approved materials consistent with the requirements for the type of construction of the building; and a fire-resistance rating shall not be required. These areas shall not be considered to be floors, stories, mezzanines or levels in applying 780 CMR.

Exception: Floors of fly galleries and catwalks shall be constructed of any approved material.

410.3.3 Exterior Stage Doors. Where protection of openings is required, exterior exit doors shall be protected with fire doors that comply with 780 CMR 715.0. Exterior openings that are located on the stage for means of egress or loading and unloading purposes, and that are likely to be open during occupancy of the theater, shall be constructed with vestibules to prevent air drafts into the auditorium.

410.3.4 Proscenium Wall. Where the stage height is greater than 50 feet (15 240 mm), all portions of the stage shall be completely separated from the seating area by a proscenium wall with not less than a two-hour fire-resistance rating extending continuously from the foundation to the roof.

410.3.5 Proscenium Curtain. The proscenium opening of every stage with a height greater than 50 feet (15 240 mm) shall be provided with a curtain of approved material or an approved water curtain complying with 780 CMR 903.3.1.1. The curtain shall be designed and installed to intercept hot gases, flames and smoke, and to prevent a glow from a severe fire on the stage from showing on the auditorium side for a period of 20 minutes. The closing of the curtain from the full open position shall be effected in less than 30 seconds, but the last eight feet (2438 mm) of travel shall require not less than five seconds.

410.3.5.1 Activation. The curtain shall be activated by rate-of-rise heat detection installed in accordance with 780 CMR 907.10 operating at a rate of temperature rise of 15° to 20°F per minute (8° to 11°°C per minute), and by an auxiliary manual control.

410.3.5.2 Fire Test. A sample curtain with a minimum of two vertical seams shall be subjected to the standard fire test specified in ASTM E 119 for a period of 30 minutes. The curtain shall overlap the furnace edges by an amount that is appropriate to seal the top and sides. The curtain shall have a bottom pocket containing a minimum of 4 pounds per linear foot (58 N/m) of batten. The exposed surface of the curtain shall not glow, and flame or smoke shall not penetrate the curtain during the test period. Unexposed surface temperature and hose stream test requirements are not applicable to the proscenium fire safety curtain test.

410.3.5.3 Smoke Test. Curtain fabrics shall have a smoke-developed rating of 25 or less when tested in accordance with ASTM E 84.

410.3.5.4 Tests. The completed proscenium curtain shall be subjected to operating tests prior to the issuance of a certificate of occupancy.

410.3.6 Scenery. See 527 CMR.

410.3.7 Stage Ventilation. Emergency ventilation shall be provided for stages larger than 1,000 square feet (93 m^2) in floor area, or with a stage height greater than 50 feet (15 240 mm). Such ventilation shall comply with 780 CMR 410.3.7.1 or 410.3.7.2.

410.3.7.1 Roof Vents. Two or more vents constructed to open automatically by approved heat-activated devices and with an aggregate clear opening area of not less than 5% of the area of the stage shall be located near the center and above the highest part of the stage area. Supplemental means shall be provided for manual operation of the ventilator. Curbs shall be provided as required for skylights in 780 CMR 2610.2. Vents shall be labeled.

410.3.7.2 Smoke Control. Smoke control in accordance with 780 CMR 909 shall be provided to maintain the smoke layer interface not less than six feet (1829 mm) above the highest level of the assembly seating or above the top of the proscenium opening where a proscenium wall is provided in compliance with 780 CMR 410.3.4.

410.4 Platform Construction. Permanent platforms shall be constructed of materials as required for the type of construction of the building in which the permanent platform is located. Permanent platforms are permitted to be constructed of fire-retardant-treated wood for Type I, II, and IV construction where the platforms are not more than 30 inches (762 mm) above the main floor, and not more than one-third of the room floor area and not more than 3,000 square feet (279 m^2) in area. Where the space beneath the permanent platform is used for storage or any other purpose other than equipment, wiring or plumbing, the floor construction shall not be less than 1-hour fire-resistance-rated construction. Where the space beneath the permanent platform is used only for equipment, wiring or plumbing, the underside of the permanent platform need not be protected.

410.4.1 Temporary Platforms. Platforms installed for a period of not more than 30 days are permitted to be constructed of any materials permitted by the code. The space between the floor and the platform above shall only be used for plumbing and electrical wiring to platform equipment.

410.5 Dressing and Appurtenant Rooms. Dressing and appurtenant rooms shall comply with 780 CMR 410.5.1 through 410.5.4.

410.5.1 Separation from Stage. Where the stage height is greater than 50 feet (15 240 mm), the stage shall be separated from dressing rooms, scene docks, property rooms, workshops, storerooms and compartments appurtenant to the stage and other parts of the building by a fire barrier wall and horizontal assemblies, or both, with not less than a two-hour fire-resistance rating with approved opening protectives. For stage heights of 50 feet (15 240 mm) or less, the required stage separation shall be a fire barrier wall and horizontal assemblies, or both, with not less a one-hour fire-resistance rating with approved opening protectives.

410.5.2 Separation from Each Other. Dressing rooms, scene docks, property rooms, workshops, storerooms and compartments appurtenant to the stage shall be separated from each other by fire barrier wall and horizontal assemblies, or both, with not less than a one-hour fire-resistance rating with approved opening protectives.

410.5.3 Opening Protectives. Openings other than to trunk rooms and the necessary doorways at stage level shall not connect such rooms with the stage, and such openings shall be protected with fire door assemblies that comply with 780 CMR 715.0.

410.5.4 Stage Exits. At least one approved means of egress shall be provided from each side of the stage; and from each side of the space under the stage. At least one means of escape shall be provided from each fly gallery and from the gridiron. A steel ladder, alternating tread stairway or spiral stairway is permitted to be provided from the gridiron to a scuttle in the stage roof.

[F] 410.6 Automatic Sprinkler System. Stages shall be equipped with an automatic fire-extinguishing system in accordance with 780 CMR 9.00. The system shall be installed under the roof and gridiron, in the tie and fly galleries, in places behind the proscenium wall of the stage, and in dressing rooms, lounges, workshops and storerooms accessory to such stages.

Exceptions:

1. Sprinklers are not required under stage areas less than 4 feet (1219 mm) in clear height utilized exclusively for storage of tables and chairs, provided the concealed space is separated from the adjacent spaces by not less than ⅝-inch (15.9 mm) Type X gypsum board.
2. Sprinklers are not required for stages 1,000 square feet (93 m^2) or less in area and 50 feet (15240 mm) or less in height where curtains, scenery or other combustible hangings are not retractable vertically. Combustible hangings

shall be limited to a single main curtain, borders, legs and a single backdrop.

[F] 410.7 Standpipes. Standpipe systems shall be provided in accordance with 780 CMR 905.0.

780 CMR 411.0 SPECIAL AMUSEMENT BUILDINGS

411.1 General. Special amusement buildings having an occupant load of 50 or more shall comply with the requirements for the appropriate Group A occupancy and 780 CMR 411.0. Amusement buildings having an occupant load of less than 50 shall comply with the requirements for a Group B occupancy and 780 CMR 411.0.

> **Exception**. Amusement buildings or portions thereof that are without walls or a roof and constructed to prevent the accumulation of smoke.

For requirements relating to flammable decorative materials, see 527 CMR.

411.2 Special Amusement Building. A special amusement building is any temporary or permanent building or portion thereof that is occupied for amusement, entertainment or educational purposes and that contains a device or system that conveys passengers or provides a walkway along, around or over a course in any direction so arranged that the means of egress path is not readily apparent due to visual or audio distractions or is intentionally confounded or is not readily available because of the nature of the attraction or mode of conveyance through the building or structure.

[F] 411.3 Automatic Fire Detection. Special amusement buildings shall be equipped with an automatic fire detection system in accordance with 780 CMR 907.0.

[F] 411.4 Automatic Sprinkler System. Special amusement buildings shall be equipped throughout with an automatic sprinkler system in accordance with 780 CMR 903.3.1.1. Where the special amusement building is temporary, the sprinkler water supply shall be of an approved temporary means.

> **Exception**. Automatic fire sprinklers are not required where the total floor area of a temporary special amusement building is less than 1,000 square feet (93 m^2) and the travel distance from any point to an exit is less than 50 feet (15240 mm).

[F] 411.5 Alarm. Actuation of a single smoke detector, the automatic sprinkler system or other automatic fire detection device shall immediately sound an alarm at the building at a constantly attended location from which emergency action can be initiated including the capability of manual initiation of requirements in 780 CMR 907.2.11.2. Refer also to 780 CMR 907.2.11.

[F] 411.6 Emergency Voice/Alarm Communications System. An emergency voice/alarm communications system shall be provided in accordance with 780 CMR 907.2.11 and 907.2.12.2 (if applicable), which is also permitted to serve as a public address system and shall be audible throughout the entire special amusement building.

411.7 Exit Marking. Exit signs shall be installed at the required exit or exit access doorways of amusement buildings. Approved directional exit markings shall also be provided. Where mirrors, mazes or other designs are utilized that disguise the path of egress travel such that they are not apparent, approved low-level exit signs and directional path markings shall be provided and located not more than eight inches (203 mm) above the walking surface and on or near the path of egress travel. Such markings shall become visible in an emergency. The directional exit marking shall be activated by the automatic fire detection system and the automatic sprinkler system in accordance with 780 CMR 907.2.11.2.

411.8 Interior Finish. The interior finish shall be Class A in accordance with 780 CMR 803.1.

780 CMR 412.0 AIRCRAFT-RELATED OCCUPANCIES

412.1 Airport Traffic Control Towers.

412.1.1 General. The provisions of 780 CMR 412.0 shall apply to airport traffic control towers not exceeding 1,500 square feet (140 m^2) per floor occupied only for the following uses:

1. Airport traffic control cab.
2. Electrical and mechanical equipment rooms.
3. Airport terminal radar and electronics rooms.
4. Office spaces incidental to the tower operation.
5. Lounges for employees, including sanitary facilities.

412.1.2 Type of Construction. Airport traffic control towers shall be constructed to conform to the height and area limitations of Table 412.1.2.

TABLE 412.1.2 HEIGHT AND AREA LIMITATIONS FOR AIRPORT TRAFFIC CONTROL TOWERS

TYPE OF CONSTRUCTION	HEIGHT[a] (feet)	MAXIMUM AREA (square feet)
IA	Unlimited	1500
IB	240	1,500
IIA	100	1,500
IIB	85	1,500
IIIA	65	1,500

For SI: 1 foot = 304.8 mm, 1 square foot = 0.093 m^2.

a. Height to be measured from grade to cab floor.

412.1.3 Egress. A minimum of one exit stairway shall be permitted for airport traffic control towers of any height provided that the occupant load per floor does not exceed 15. The stairway shall conform to the requirements of 780 CMR 1009. The stairway shall be separated from elevators by a minimum distance of one-half of the diagonal of the area served measured in a straight line. The exit stairway and elevator hoistway are permitted to be located in the same shaft enclosure, provided they are separated from each other by a 4-hour separation having no openings. Such stairway shall be pressurized to a minimum of 0.15 inch of water column (43 Pa) and a maximum of 0.35 inch of water column (101 Pa) in the shaft relative to the building with stairway doors closed. Stairways need not extend to the roof as specified in 780 CMR 1009.12. The provisions of 780 CMR 403 do not apply.

Exception. Smokeproof enclosures as set forth in 780 CMR 1019.1.8 are not required where required stairways are pressurized.

[F] 412.1.4 Automatic Fire Detection Systems. Airport traffic control towers shall be provided with an automatic fire detection system installed in accordance with 780 CMR 907.2.

[F] 412.1.5 Standby Power. A standby power system that conforms to NFPA-110 or NFPA-111, as applicable and electrically installed in accordance with the requirements of 527 CMR 12.00 shall be provided in airport traffic control towers more than 65 feet (19 812 mm) in height. Power shall be provided to the following equipment:

1. Pressurization equipment, mechanical equipment and lighting.
2. Elevator operating equipment.
3. Fire alarm and smoke detection systems.

412.1.6 Accessibility. Refer to the Architectural Access Code, 521 CMR.

412.2 Aircraft Hangar.

412.2.1 Exterior Walls. Exterior walls located less than 30 feet (9 144 mm) from property lines, lot lines or a public way shall have a fire-resistance rating not less than two hours.

412.2.2 Basements. Where hangars have basements, the floor over the basement shall be of Type IA construction and shall be made tight against seepage of water, oil or vapors. There shall be no opening or communication between the basement and the hangar. Access to the basement shall be from outside only.

412.2.3 Floor Surface. Floors shall be graded and drained to prevent water or fuel from remaining on the floor. Floor drains shall discharge through an oil separator to the sewer or to an outside vented sump.

412.2.4 Heating Equipment. Heating equipment shall be placed in another room separated by two-hour fire-resistance-rated construction. Entrance shall be from the outside or by means of a vestibule providing a two-doorway separation.

Exceptions:

1. Unit heaters suspended at least ten feet (3048 mm) above the upper surface of wings or engine enclosures of the highest aircraft that are permitted to be housed in the hangar and at least eight feet (2438 mm) above the floor in shops, offices and other sections of the hangar communicating with storage or service areas.
2. A single interior door shall be allowed, provided the sources of ignition in the appliances are at least 18 inches (457 mm) above the floor.

412.2.5 Finishing. The process of "doping," involving use of a volatile flammable solvent, or of painting, shall be carried on in a separate detached building equipped with automatic fire-extinguishing equipment in accordance with 780 CMR 903. See 527 CMR as such relates to finishing.

412.2.6 Fire Suppression. Aircraft hangars shall be provided with fire suppression as required in NFPA 409.

Exception. Group II hangars as defined in NFPA 409 storing private aircraft without major maintenance or overhaul are exempt from foam suppression requirements.

412.3 Residential Aircraft Hangars. Residential aircraft hangars as defined in 780 CMR 412.3.1 shall comply with 780 CMR 412.3.2 through 412.3.6.

412.3.1 Definition. The following word and term shall, for the purposes of 780 CMR 4.00 and as used elsewhere in 780 CMR, have the meaning shown in 780 CMR 412.3.1.

RESIDENTIAL AIRCRAFT HANGAR. An accessory building less than 2,000 square feet (186 m^2) and 20 feet (6096 mm) in height, constructed on a one- or two-family residential property where aircraft are stored. Such use will be considered as a residential accessory use incidental to the dwelling.

412.3.2 Fire Separation. A hangar shall not be attached to a dwelling unless separated by walls having a fire-resistance rating of not less than 1 hour. Such separation shall be continuous from the foundation to the underside of the roof and unpierced except for doors leading to the dwelling unit. Doors into the dwelling unit must be equipped with self-closing devices and conform to the requirements of 780 CMR 715.0 with at least a four-inch (102 mm) noncombustible raised sill. Openings from a hanger directly into a room used for sleeping purposes shall not be permitted.

412.3.3 Egress. A hangar shall provide two means of egress. One of the doors into the dwelling shall be considered as meeting only one of the two means of egress.

[F] 412.3.4 Smoke Detection. Smoke alarms shall be provided within the hangar in accordance with 780 CMR 907.2.21.

412.3.5 Independent Systems. Mechanical and plumbing drain, waste and vent (DWV) systems installed within the hangar and the systems installed within the dwelling shall conform to the requirements of the applicable Specialized Code, including 248 CMR.

Exception:. For Smoke detector wiring and feed for electrical subpanels in the hangar, refer to 780 CMR and 527 CMR 12.00.

412.3.6 Height and Area Limits. Residential aircraft hangars shall not exceed 2,000 square feet (186 m^2) in area and 20 feet (6096 mm) in height.

412.4 Aircraft Paint Hangars. Aircraft painting operations where flammable liquids are used in excess of the maximum allowable quantities per control area listed in Table 307.7(1) shall be conducted in an aircraft paint hangar that complies with the provisions of 780 CMR 412.4.

412.4.1 Occupancy Group. Aircraft paint hangars shall be classified as Group H-2. Aircraft paint hangars shall comply with the applicable requirements of 780 CMR and the *International Fire Code* for such occupancy.

412.4.2 Construction. The aircraft paint hangar shall be of Type I or II construction.

412.4.3 Operations. Only those flammable liquids necessary for painting operations shall be permitted in quantities less than the maximum allowable quantities per control area in Table 307.7(1). Spray equipment cleaning operations shall be conducted in a liquid use, dispensing and mixing room.

412.4.4 Storage. See applicable portions of 780 CMR and 527 CMR.

412.4.5 Fire Suppression. Aircraft paint hangars shall be provided with fire suppression as required in NFPA 409.

412.4.6 Ventilation. Aircraft paint hangars shall be provided with ventilation as required in the *International Mechanical Code*.

412.5 Heliports and Helistops.

412.5.1 General. Heliports and helistops may be erected on buildings or other locations where they are constructed in accordance with 780 CMR 412.0.

412.5.2 Definitions. The following words and terms shall, for the purposes of 780 CMR 4.00 and as used elsewhere in 780 CMR, have the meanings shown in 780 CMR 412.5.2.

HELIPORT. An area of land or water or a structural surface that is used, or intended for use, for the landing and taking off of helicopters, and any appurtenant areas that are used, or intended for use, for heliport buildings and other heliport facilities.

HELISTOP. The same as a "Heliport," except that no fueling, defueling, maintenance, repairs or storage of helicopters is permitted.

412.5.3 Size. The touchdown or landing area for helicopters of less than 3,500 pounds (1588 kg) shall be a minimum of 20 feet (6096 mm) in length and width. The touchdown area shall be surrounded on all sides by a clear area having a minimum average width at roof level of 15 feet (4572 mm) but with no width less than five feet (1524 mm).

412.5.4 Design. Helicopter landing areas and the supports thereof on the roof of a building shall be noncombustible construction. Landing areas shall be designed to confine any flammable liquid spillage to the landing area itself and provisions shall be made to drain such spillage away from any exit or stairway serving the helicopter landing area or from a structure housing such exit or stairway. For structural design requirements, see 780 CMR 16.00.

412.5.5 Means of Egress. The means of egress from heliports and helistops shall comply with the provisions of 780 CMR 10.00. Landing areas located on buildings or structures shall have two or more means of egress. For landing platforms or roof areas less than 60 feet (18288 mm) in length, or less than 2,000 square feet (187 m^2) in area, the second means of egress may be a fire escape or ladder leading to the floor below.

412.5.6 Rooftop Heliports and Helistops. Rooftop heliports and helistops shall comply with NFPA 418.

780 CMR 413.0 COMBUSTIBLE STORAGE

413.1 General. High-piled stock or rack storage in any occupancy group shall comply with requirements of the International Fire Code and 527 CMR.

413.2 Attic, Under-floor and Concealed Spaces. Attic, under-floor and concealed spaces used for storage of combustible materials shall be protected on the storage side as required for one-hour fire-resistance-rated construction. Openings shall be protected by assemblies that are self-closing and are of noncombustible construction or solid wood core not less than 1¾ inch (45 mm) in thickness.

Exceptions:

1. Areas protected by approved automatic sprinkler systems.
2. Group R-3 and U occupancies.

[F] 780 CMR 414.0 HAZARDOUS MATERIALS

414.1 General.* *The provisions of 780 CMR 414.0 shall apply to buildings and structures occupied for the manufacturing, processing, dispensing, use or storage of hazardous materials.

Exception: Also see 780 CMR 424.0, Bulk Merchandizing Retail Buildings.

414.1.1 Other Provisions. Buildings and structures with an occupancy in Group H shall also comply with the applicable provisions of 780 CMR 415.0, the *International Fire Code* and 527 CMR, as applicable.

414.1.2 Materials. The safe design of hazardous material occupancies is material dependent. Individual material requirements are also found in 780 CMR 307.0 and 415.0, and in the International Mechanical Code and the International Fire Code; additionally, 527 CMR likewise defines material quantities for which compliance with 527 CMR is required.

414.1.2.1 Aerosols. Level 2 and 3 aerosol products shall be stored and displayed in accordance with the International Fire Code; additionally, 527 CMR likewise defines material quantities for which compliance with 527 CMR is required. See 780 CMR 311.2 and the International Fire Code for occupancy group requirements.

414.1.3 Information Required. Separate floor plans shall be submitted for buildings and structures with an occupancy in Group H, identifying the locations of anticipated contents and processes so as to reflect the nature of each occupied portion of every building and structure. A report identifying hazardous materials including, but not limited to, materials representing hazards that are classified in Group H to be stored or used, shall be submitted and the methods of protection from such hazards shall be indicated on the construction documents. The opinion and report shall be prepared by a qualified person, firm or corporation approved by the building official and shall be provided without charge to the enforcing agency.

414.2 Control Areas. Control areas shall be those spaces within a building where quantities of hazardous materials not exceeding the maximum quantities allowed by 780 CMR are stored, dispensed, used or handled.

414.2.1 Construction Requirements. Control areas shall be separated from each other by not less than a one-hour fire barrier constructed in accordance with 780 CMR 7.00.

414.2.2 Number. The maximum number of control areas within a building shall be in accordance with Table 414.2.2.

414.2.3 Separation. The required fire-resistance rating for fire barrier assemblies shall be in accordance with Table 414.2.2. The floor construction of the control area, and the construction supporting the floor of the control area, shall have a minimum two-hour fire-resistance rating.

TABLE 414.2.2 DESIGN AND NUMBER OF CONTROL AREAS

FLOOR LEVEL		PERCENTAGE OF THE MAXIMUM ALLOWABLE QUANTITY PER CONTROL AREA[a]	NUMBER OF CONTROL AREAS PER FLOOR[b]	FIRE-RESISTANCE RATING FOR FIRE BARRIERS IN HOURS[c]
Above grade	Higher than 9	5	1	2
	39637	5	2	2
	6	12.5	2	2
	5	12.5	2	2
	4	12.5	2	2
	3	50	2	1
	2	75	3	1
	1	100	4	1
Below grade	1	75	3	1
	2	50	2	1
	Lower than 2	Not Allowed	Not Allowed	Not Allowed

a. Percentages shall be of the maximum allowable quantity per control area shown in Tables 307.7(1) and 307.7(2), with all increases allowed in the notes to those tables.

b. There shall be a maximum of two control areas per floor in Group M occupancies and in buildings or portions of buildings having Group S occupancies with storage conditions and quantities in accordance with 780 CMR 414.2.4.

c. Fire barriers shall include walls and floors as necessary to provide separation from other portions of the building.

414.2.4 Hazardous Material in Group M Display and Storage Areas and in Group S Storage Areas. The aggregate quantity of nonflammable solid and nonflammable or noncombustible liquid hazardous materials permitted within a single control area of a Group M or S occupancy or an outdoor control area is permitted to exceed the maximum allowable quantities per control area specified in Tables 307.7(1) and 307.7(2) without classifying the building or use as a Group H occupancy, provided that the materials are displayed and stored in accordance with the *International Fire Code* and 527 CMR and quantities do not exceed the maximum allowable specified in Table 414.2.4.

414.3 Ventilation. Rooms, areas or spaces of Group H in which explosive, corrosive, combustible, flammable or highly toxic dusts, mists, fumes, vapors or gases are or may be emitted due to the processing, use, handling or storage of materials shall be mechanically ventilated as required by the *International Fire Code* and the *International Mechanical Code.*

Ducts conveying explosives or flammable vapors, fumes or dusts shall extend directly to the exterior of the building without entering other spaces. Exhaust ducts shall not extend into or through ducts and plenums.

TABLE 414.2.4 MAXIMUM ALLOWABLE QUANTITY PER INDOOR AND OUTDOOR CONTROL AREA IN GROUP M AND S OCCUPANCIES NONFLAMMABLE SOLIDS AND NONFLAMMABLE AND NONCOMBUSTIBLE LIQUIDS[d, e, f]

CONDITION		MAXIMUM ALLOWABLE QUANTITY PER CONTROL AREA	
Material[a]	**Class**	**Solids pounds**	**Liquids gallons**
A. Health-hazard materials—nonflammable and noncombustible solids and liquids			
Corrosives[b, c]	Not Applicable	9,750	975
Highly toxics	Not Applicable	20[b, c]	2[b, c]
3. Toxics[b, c]	Not Applicable	1,000	100
B. Physical-hazard materials—nonflammable and noncombustible solids and liquids			
1. Oxidizers[b, c]	4	Not Allowed	Not Allowed
	3	1,150[g]	115
	2	2,250[h]	225
	1	18,000[i, j]	1,800[i, j]
2. Unstable (reactives)[b, c]	4	Not Allowed	Not Allowed
	3	550	55
	2	1,150	115
	1	Not Limited	Not Limited
3. Water (reactives)	3[b, c]	550	55
	2[b, c]	1,150	115
	1	Not Limited	Not Limited

For SI: 1 pound = 0.454 kg, 1 gallon = 3.785 L.

a. Hazard categories are as specified in the *International Fire Code.*

b. Maximum allowable quantities shall be increased 100% in buildings that are sprinkled in accordance with 780 CMR 903 .3.1.1. When Note c also applies, the increase for both notes shall be applied accumulatively.

c. Unless otherwise restricted by requirements of 527 CMR, maximum allowable quantities shall be increased 100% when stored in approved storage cabinets, in accordance with the *International Fire Code.* When Note b also applies, the increase for both notes shall be applied accumulatively.

d. See Table 414.2.2 for design and number of control areas.

e. Allowable quantities for other hazardous material categories shall be in accordance with 780 CMR 307.0.

f. Maximum quantities shall be increased 100% in outdoor control areas.

g. Maximum amounts are permitted to be increased to 2,250 pounds when individual packages are in the original sealed containers from the manufacturer or packager and do not exceed ten pounds each.

h. Maximum amounts are permitted to be increased to 4,500 pounds when individual packages are in the original sealed containers from the manufacturer or packager and do not exceed ten pounds each.

i. The permitted quantities shall not be limited in a building equipped throughout with an automatic sprinkler system in accordance with 780 CMR 903.3.1.1

j. Quantities are unlimited in an outdoor control area.

Exception. Ducts conveying vapor or fumes having flammable constituents less than 25% of their lower flammable limit (LFL) are permitted to pass through other spaces.

Emissions generated at workstations shall be confined to the area in which they are generated as specified in the *International Fire Code* and the *International Mechanical Code*.

The location of supply and exhaust openings shall be in accordance with the *International Mechanical Code*. Exhaust air contaminated by highly toxic material shall be treated in accordance with the *International Fire Code*.

A manual shutoff control for ventilation equipment required by 780 CMR 414.0 shall be provided outside the room adjacent to the principal access door to the room. The switch shall be of the break-glass type and shall be labeled: VENTILATION SYSTEM EMERGENCY SHUTOFF.

414.4 Hazardous Material Systems. Systems involving hazardous materials shall be suitable for the intended application. Controls shall be designed to prevent materials from entering or leaving process or reaction systems at other than the intended time, rate or path. Automatic controls, where provided, shall be designed to be fail safe.

414.5 Inside Storage, Dispensing and Use. *The inside storage, dispensing and use of hazardous materials in excess of the maximum allowable quantities per control area of Tables 307.7(1) and 307.7(2) shall be in accordance with 780 CMR 414.5.1 through 414.5.5, the requirements of the International Fire Code; additionally the storage, dispensing and use of hazardous materials is likewise regulated by 527 CMR.*

414.5.1 Explosion control. Explosion control shall be provided in accordance with the International Fire Code as required by Table 414.5.1 where quantities of hazardous materials specified in that table exceed the maximum allowable quantities in Table 307.7(1) or where a structure, room or space is occupied for purposes involving explosion hazards as required by 780 CMR 415 or the International Fire Code; additionally, explosion controls for certain hazardous materials is likewise regulated by 527 CMR.

TABLE 414.5.1 EXPLOSION CONTROL REQUIREMENTS[a]

MATERIAL	CLASS	EXPLOSION CONTROL METHODS	
		Barricade construction	Explosion (deflagration) venting or explosion (deflagration) prevention systems[b]
HAZARD CATEGORY			
Combustible dusts[c]	—	Not Required	Required
Cryogenic flammables	—	Not Required	Required
Explosives	Division 1.1 Division 1.2 Division 1.3 Division 1.4 Division 1.5 Division 1.6	Required Required Not Required Not Required Required Required	Not Required Not Required Required Required Not Required Not Required
Flammable gas	Gaseous Liquefied	Not Require Not Required	Required Required
Flammable liquid	IA[d] IB[e]	Not Required Not Required	Required Required
Organic peroxides	U I	Required Required	Not Permitted Not Permitted
Oxidizer liquids and solids	4	Required	Not Permitted
Pyrophoric gas	—	Not Required	Required
Unstable (reactive)	4 3 Detonable 3 Nondetonable	Required Required Not Required	Not Permitted Not Permitted Required
Water-reactive liquids and solids	3 2[g]	Not Required Not Required	Required Required
SPECIAL USES			
Acetylene generator rooms	—	Not Required	Required
Grain processing	—	Not Required	Required
Liquefied petroleum gas-distribution facilities	—	Not Required	Required
Where explosion hazards exist[f]	Detonation Deflagration	Required Not Required	Not Permitted Required

a. *See* 780 CMR 414.1.3.
b. See the *International Fire Code*.
c. As generated during manufacturing or processing. See definition of "Combustible dust" in 780 CMR 3.00.
d. Storage or use.
e. In open use or dispensing.
f. Rooms containing dispensing and use of hazardous materials when an explosive environment can occur because of the characteristics or nature of the hazardous materials or as a result of the dispensing or use process.
g. A method of explosion control shall be provided when Class 2 water-reactive materials can form potentially explosive mixtures.

414.5.2 Monitor Control Equipment. Monitor control equipment shall be provided where required by the *International Fire Code.*

414.5.3 Automatic Fire Detection Systems. Group H occupancies shall be provided with an automatic fire detection system in accordance with 780 CMR 907.2.

414.5.4 Standby or Emergency Power. Where mechanical ventilation, treatment systems, temperature control, alarm, detection or other electrically operated systems are required, such systems shall be provided with an emergency or standby power system in accordance with NFPA 110 or NFPA 111 as applicable and electrical installation of such emergency or standby power systems shall be in accordance with 527 CMR 12.00.

Exceptions:

1. Storage areas for Class I and II oxidizers.
2. Storage areas for Class III, IV and V organic peroxides.
3. Storage, use and handling areas for highly toxic or toxic materials as provided for in the *International Fire Code*.
4. Standby power for mechanical ventilation, treatment systems and temperature control systems shall not be required where an approved fail-safe engineered system is installed.

414.5.5 Spill Control, Drainage and Containment. Rooms, buildings or areas occupied for the storage of solid and liquid hazardous materials shall be provided with a means to control spillage and to contain or drain off spillage and fire protection water discharged in the storage area where required in the *International Fire Code*. The methods of spill control shall be in accordance with the *International Fire Code*.

414.6 Outdoor Storage, Dispensing and Use. The outdoor storage, dispensing and use of hazardous materials shall be in accordance with the *International Fire Code*.

414.6.1 Weather Protection. Where weather protection is provided for sheltering outdoor hazardous material storage or use areas, such storage or use shall be considered outdoor storage or use, provided that all of the following conditions are met:

1. Structure supports and walls shall not obstruct more than one side nor more than 25% of the perimeter of the storage or use area.
2. The distance from the structure and the structure supports to buildings, lot lines, public ways or means of egress to a public way shall not be less than the distance required for an outside hazardous material storage or use area without weather protection.
3. The overhead structure shall be of approved noncombustible construction with a maximum area of 1,500 square feet (140 m^2).

Exception. The increases permitted by 780 CMR 506.0 apply.

414.7 Emergency Alarms. Emergency alarms for the detection and notification of an emergency condition in Group H occupancies shall be provided as set forth in 780 CMR 414.7.

414.7.1 Storage. An approved manual emergency alarm system shall be provided in buildings, rooms or areas used for storage of hazardous materials. Emergency alarm-initiating devices shall be installed outside of each interior exit or exit access door of storage buildings, rooms or areas. Activation of an emergency alarm-initiating device shall sound a local alarm to alert occupants of an emergency situation involving hazardous materials.

414.7.2 Dispensing, Use and Handling. Where hazardous materials having a hazard ranking of 3 or 4 in accordance with NFPA 704 are transported through corridors or exit enclosures, there shall be an emergency telephone system, a local manual alarm station or an approved alarm-initiating device at not more than 150-foot (45 720 mm) intervals and at each exit and exit access doorway throughout the transport route. The signal shall be relayed to an approved central, proprietary or remote station service or constantly attended on-site location and shall also initiate a local audible alarm.

414.7.3 Supervision. Emergency alarm systems shall be supervised by an approved central, proprietary or remote station service or shall initiate an audible and visual signal at a constantly attended on-site location.

[F] 780 CMR 415.0 GROUPS H-1, H-2, H-3, H-4 AND H-5

415.1 Scope. The provisions of 780 CMR 415.0 shall apply to the storage and use of hazardous materials in excess of the maximum allowable quantities per control area listed in 780 CMR 307.9. Buildings and structures with an occupancy in Group H shall also comply with the applicable provisions of 780 CMR 414.0, the *International Fire Code*, and 527 CMR as applicable.

Exceptions:

1. Also see 780 CMR 424.0, Bulk Merchandizing Retail Buildings.

2. See 780 CMR 401.1, Exception.

415.2 Definitions. The following words and terms shall, for the purposes of 780 CMR 4.00 and as used elsewhere in the code, have the meanings shown in 780 CMR 415.2.

CONTINUOUS GAS-DETECTION SYSTEM. A gas detection system where the analytical instrument is maintained in continuous operation and sampling is performed without interruption. Analysis is allowed to be performed on a cyclical basis at intervals not to exceed 30 minutes.

EMERGENCY CONTROL STATION. An approved location on the premises where signals from emergency equipment are received and which is staffed by trained personnel.

EXHAUSTED ENCLOSURE. An appliance or piece of equipment that consists of a top, a back and two sides providing a means of local exhaust for capturing gases, fumes, vapors and mists. Such enclosures include laboratory hoods, exhaust fume hoods and similar appliances and equipment used to locally retain and exhaust the gases, fumes, vapors and mists that could be released. Rooms or areas provided with general ventilation, in themselves, are not exhausted enclosures.

FABRICATION AREA. An area within a semiconductor fabrication facility and related research and development areas in which there are processes using hazardous production materials. Such areas are allowed to include ancillary rooms or areas such as dressing rooms and offices that are directly related to the fabrication area processes.

FLAMMABLE VAPORS OR FUMES. The concentration of flammable constituents in air that exceed 10% of their lower flammable limit (LFL).

GAS CABINET. A fully enclosed, noncombustible enclosure used to provide an isolated environment for compressed gas cylinders in storage or use. Doors and access ports for exchanging cylinders and accessing pressure-regulating controls are allowed to be included.

GAS ROOM. A separately ventilated, fully enclosed room in which only compressed gases and associated equipment and supplies are stored or used.

HAZARDOUS PRODUCTION MATERIAL (HPM). A solid, liquid or gas associated with semiconductor manufacturing that has a degree-of-hazard rating in health, flammability or reactivity of Class 3 or 4 as ranked by NFPA 704 and which is used directly in research, laboratory or production processes that have as their end product materials that are not hazardous.

HPM FLAMMABLE LIQUID. An HPM liquid that is defined as either a Class I flammable liquid or a Class II or Class IIIA combustible liquid.

HPM ROOM. A room used in conjunction with or serving a Group H-5 occupancy, where HPM is stored or used and which is classified as a Group H-2, H-3 or H-4 occupancy.

IMMEDIATELY DANGEROUS TO LIFE AND HEALTH (IDLH). The concentration of air-borne contaminants which poses a threat of death, immediate or delayed permanent adverse health effects, or effects that could prevent escape from such an environment. This contaminant concentration level is established by the National Institute of Occupational Safety and Health (NIOSH) based on both toxicity and flammability. It generally is expressed in parts per million by volume (ppm v/v) or milligrams per cubic meter (mg/m^3). If adequate data do not exist for precise establishment of IDLH concentrations, an independent certified industrial hygienist, industrial toxicologist, appropriate regulatory agency or other source approved by the code official shall make such determination.

LIQUID. A material that has a melting point that is equal to or less than 68°F (20°C) and a boiling point that is greater than 68°F (20°C) at 14.7 pounds per square inch absolute (psia) (101 kPa). When not otherwise identified, the term "liquid" includes both flammable and combustible liquids.

LIQUID STORAGE ROOM. A room classified as a Group H-3 occupancy used for the storage of flammable or combustible liquids in an unopened condition.

LIQUID USE, DISPENSING AND MIXING ROOMS. Rooms in which Class I, II and IIIA flammable or combustible liquids are used, dispensed or mixed in open containers.

LOWER FLAMMABLE LIMIT (LFL). The minimum concentration of vapor in air at which propagation of flame will occur in the presence of an ignition source. The LFL is sometimes referred to as "LEL" or "lower explosive limit."

NORMAL TEMPERATURE AND PRESSURE (NTP). A temperature of 70°F (21°C) and a pressure of one atmosphere [14.7 psia (101 kPa)].

SERVICE CORRIDOR. A fully enclosed passage used for transporting HPM and purposes other than required means of egress.

SOLID. A material that has a melting point, decomposes or sublimes at a temperature greater than 68°F (20°C).

STORAGE, HAZARDOUS MATERIALS.

1. The keeping, retention or leaving of hazardous materials in closed containers, tanks, cylinders or similar vessels, or
2. Vessels supplying operations through closed connections to the vessel.

USE (MATERIAL). Placing a material into action, including solids, liquids and gases.

WORK STATION. A defined space or an independent principal piece of equipment using HPM within a fabrication area where a specific function, laboratory procedure or research activity occurs. Approved or listed hazardous materials storage cabinets, flammable liquid storage cabinets or gas cabinets serving a workstation are included as part of the workstation. A workstation is allowed to contain ventilation equipment, fire protection devices, detection devices, electrical devices and other processing and scientific equipment.

415.3 Location on Property. Group H shall be located on property in accordance with the other provisions of 780 CMR 4.00. In Group H-2 or H-3, not less than 25% of the perimeter wall of the occupancy shall be an exterior wall; additionally, location on property requirements are likewise regulated by 527 CMR

415.3.1 Group H Minimum Distance to Lot Lines. Regardless of any other provisions, buildings containing Group H occupancies shall be set back a minimum distance from lot lines as set forth in 780 CMR 415.3.1 Items 1 through 4. Distances shall be measured from the walls enclosing the occupancy to lot lines, including those on a public way. Distances to assumed property lines drawn for the purposes of determination of exterior wall and opening protection are not to be used to establish the minimum distance for separation of buildings on sites where explosives are manufactured or used when separation is provided in accordance with the quantity distance tables specified for explosive materials in the *International Fire Code (Note that additionally, 527 CMR likewise regulates certain H-Use locations to lot lines and./o other buildings)* .

1. Group H-1. Not less than 75 feet (22 860 mm) and not less than required by the *International Fire Code*.

Exceptions:

1. Fireworks manufacturing buildings separated in accordance with NFPA 1124.
2. Buildings containing the following materials when separated in accordance with Table 415.3.1:
   - 2.1. Organic peroxides, unclassified detonable.
   - 2.2. Unstable reactive materials Class 4.
   - 2.3. Unstable reactive materials, Class 3 detonable.
   - 2.4. Detonable pyrophoric materials.

2. Group H-2. Not less than 30 feet (9144 mm) where the area of the occupancy exceeds 1,000 square feet (93 m^2) and it is not required to be located in a detached building.

3. Groups H-2 and H-3. Not less than 50 feet (15 240 mm) where a detached building is required (see Table 415.3.2).

4. Groups H-2 and H-3. Occupancies containing materials with explosive characteristics shall be separated as required by the *International Fire Code and 527 CMR*. Where separations are not specified, the distances required shall not be less than the distances required by Table 415.3.1.

415.3.2 Group H-1 and H-2 or H-3 Detached Buildings. Where a detached building is required by Table 415.3.2, there are no requirements for wall and opening protection based on location on property.

415.4 Special Provisions for Group H-1 Occupancies. Group H-1 occupancies shall be in buildings used for no other purpose, shall not exceed one story in height and be without abasement, crawl spaces or other under-floor spaces. Roofs shall be of lightweight construction with suitable thermal insulation to prevent sensitive material from reaching its decomposition temperature.

Group H-1 occupancies containing materials which are in themselves both physical and health hazards in quantities exceeding the maximum allowable quantities per control area in Table 307.7.(2) shall comply with requirements for both Group H-1 and H-4 occupancies

415.4.1 Floors in Storage Rooms. Floors in storage areas for organic peroxides, pyrophoric materials and unstable (reactive) materials shall be of liquid-tight, noncombustible construction.

TABLE 415.3.1 MINIMUM SEPARATION DISTANCES FOR BUILDINGS CONTAINING EXPLOSIVE MATERIALS (See also 527 CMR)

QUANTITY OF EXPLOSIVE MATERIAL[a]		MINIMUM DISTANCE (feet)		
		Lot lines[b] and inhabited buildings[c]		Separation of Magazines[d, e, f]
Pounds over	Pounds not over	Barricaded[d]	Unbarricaded	
2	5	70	140	12
5	10	90	180	16
10	20	110	220	20
20	30	125	250	22
30	40	140	280	24
40	50	150	300	28
50	75	170	340	30
75	100	190	380	32
100	125	200	400	36
125	150	215	430	38
150	200	235	470	42
200	250	255	510	46
250	300	270	540	48
300	400	295	590	54
400	500	320	640	58
500	600	340	680	62
600	700	355	710	64
700	800	375	750	66
800	900	390	780	70
900	1,000	400	800	72
1,000	1,200	425	850	78
1,200	1,400	450	900	82
1,400	1,600	470	940	86
1,600	1,800	490	980	88
1,800	2,000	505	1,010	90
2,000	2,500	545	1,090	98
2,500	3,000	580	1,160	104
3,000	4,000	635	1,270	116
4,000	5,000	685	1,370	122
5,000	6,000	730	1,460	130
6,000	7,000	770	1,540	136
7,000	8,000	800	1,600	144
8,000	9,000	835	1,670	150
9,000	10,000	865	1,730	156
10,000	12,000	875	1,750	164
12,000	14,000	885	1,770	174
14,000	16,000	900	1,800	180
16,000	18,000	940	1,880	188
18,000	20,000	975	1,950	196
20,000	25,000	1,055	2,000	210
25,000	30,000	1,130	2,000	224
30,000	35,000	1,205	2,000	238
35,000	40,000	1,275	2,000	248
40,000	45,000	1,340	2,000	258
45,000	50,000	1,400	2,000	270
50,000	55,000	1,460	2,000	280
55,000	60,000	1,515	2,000	290
60,000	65,000	1,565	2,000	300
65,000	70,000	1,610	2,000	310
70,000	75,000	1,655	2,000	320
75,000	80,000	1,695	2,000	330
80,000	85,000	1,730	2,000	340
85,000	90,000	1,760	2,000	350
90,000	95,000	1,790	2,000	360
95,000	100,000	1,815	2,000	370
100,000	110,000	1,835	2,000	390
110,000	120,000	1,855	2,000	410
120,000	130,000	1,875	2,000	430
130,000	140,000	1,890	2,000	450
140,000	150,000	1,900	2,000	470
150,000	160,000	1,935	2,000	490
160,000	170,000	1,965	2,000	510
170,000	180,000	1,990	2,000	530
180,000	190,000	2,010	2,010	550
190,000	200,000	2,030	2,030	570

TABLE 415.3.1 MINIMUM SEPARATION DISTANCES FOR BUILDINGS CONTAINING EXPLOSIVE MATERIALS (See also 527 CMR) - continued

QUANTITY OF EXPLOSIVE MATERIAL[a]		MINIMUM DISTANCE (feet)		
		Lot lines[b] and inhabited buildings[c]		Separation of Magazines[d, e, f]
Pounds over	Pounds not over	Barricaded[d]	Unbarricaded	
200,000	210,000	2,055	2,055	590
210,000	230,000	2,100	2,100	630
230,000	250,000	2,155	2,155	670
250,000	275,000	2,215	2,215	720
275,000	300,000	2,275	2,275	770

For SI: 1 pound = 0.454 kg, 1 foot = 304.8 mm.

a. The number of pounds of explosives listed is the number of pounds of trinitrotoluene (TNT) or the equivalent pounds of other explosive.

b. The distance listed is the distance to lot line, including lot lines at public ways.

c. For the purpose of TABLE 415.3.1, an inhabited building is any building on the same property that is regularly occupied by people. Where two or more buildings contain ing explosives or magazines are located on the same property, each building or magazine shall comply with the minimum distances specified from inhabited build ings and, in addition, they shall be separated from each other by not less than the distance shown for "Separation of magazines," except that the quantity of explosive materials contained in detonator buildings or magazines shall govern in regard to the spacing of said detonator buildings or magazines from buildings or magazines containing other explosive materials. If any two or more buildings or magazines are separated from each other by less than the specified "Separation of Magazines"distances, then such two or more buildings or magazines, as a group, shall be considered as one building or magazine, and the total quantity of explo sive materials stored in such group shall be treated as if the explosive were in a single building or magazine located on the site of any building or magazine of the group, and shall comply with the minimum distance specified from other magazines or inhabited buildings.

d. Barricades shall effectively screen the building containing explosives from other buildings, public ways or magazines. Where mounds or revetted walls of earth are used for barricades, they shall not be less than three feet in thickness. A straight line from the top of any side wall of the building containing explosive materials to the eave line of any other building, magazine or a point 12 feet above the centerline of a public way shall pass through the barricades.

e. Unless otherwise restricted by requirements of 527 CMR , a magazine is a building or structure, other than an operating building, approved for storage of explosive materials. Portable or mobile magazines not exceeding 120 square feet (11 m^2) in area need not comply with the requirements of 780 CMR, however, all magazines shall comply with the *International Fire Code*.

f. The distance listed is permitted be reduced by 50% where approved natural or artificial barriers are provided in accordance with the requirements in Note d.

TABLE 415.3.2 REQUIRED DETACHED STORAGE

DETACHED STORAGE IS REQUIRED WHEN THE QUANTITY OF MATERIAL EXCEEDS THAT LISTED IN TABLE 1415.3.2 (See also 527 CMR)			
Material	**Class**	**Solids and Liquids (tons)[a,b]**	**Gases (cubic feet)[a,b]**
Explosives	Division 1.1	Maximum Allowable Quantity	Not Applicable
	Division 1.2	Maximum Allowable Quantity	
	Division 1.3	Maximum Allowable Quantity	
	Division 1.4	Maximum Allowable Quantity	
	Division 1.4[c]	1	
	Division 1.5	Maximum Allowable Quantity	
	Division 1.7	Maximum Allowable Quantity	
Oxidizers	Class 4	Maximum Allowable Quantity	Maximum Allowable Quantity
Unstable (reactives) detonable	Class 3 or 4	Maximum Allowable Quantity	Maximum Allowable Quantity
Oxidizer, liquids and solids	Class 3	1,200	Not Applicable
	Class 2	2,000	Not Applicable
Organic peroxides	Detonable	Maximum Allowable Quantity	Not Applicable
	Class I	Maximum Allowable Quantity	Not Applicable
	Class II	25	Not Applicable
	Class III	50	Not Applicable
Unstable (reactives) nondetonable	Class 3	1	2,000
	Class 2	25	10,000
Water reactives	Class 3	1	Not Applicable
	Class 2	25	Not Applicable
Pyrphoric gases	Not Applicable	Not Applicable	2,000

For SI: 1 ton = 906 kg, 1 cubic foot = 0.02832 M^3.

a. Unless otherwise restricted by requirements of 527 CMR, for materials that are detonable, the distance to other buildings or lot lines shall be as specified in Table 415.3.1 based on trinitrotoluene (TNT) equivalence of the material. For materials classified as explosives, see the *International Fire Code*, Chapter 33. For all other materials, the distance shall be as indicated in 780 CMR 415.3.1.

b. "Maximum Allowable Quantity" means the maximum allowable quantity per control area set forth in Table 3 07.7(1).

c. Limited to Division 1.4 materials and articles, including articles packaged for shipment, that are not regulated as an explosive under Bureau of Alcohol, Tobacco and Firearms (BATF) regulations or unpackaged articles used in process operations that do not propagate a detonation or deflagration between articles, providing the net explosive weight of individual articles does not exceed one pound.

415.5 Special Provisions for Group H-2 and H-3 Occupancies. Group H-2 and H-3 occupancies containing quantities of hazardous materials in excess of those set forth in Table 415.3.2 shall be in buildings used for no other purpose, shall not exceed one story in height and shall be without basements, crawl spaces or other under-floor spaces.

Group H-2 and H-3 occupancies containing water-reactive materials shall be resistant to water penetration. Piping for conveying liquids shall not be over or through areas containing water reactives, unless isolated by approved liquid-tight construction.

Exception. Fire protection piping.

415.5.1 Floors in Storage Rooms. Floors in storage areas for organic peroxides, oxidizers, pyrophoric materials, unstable (reactive) materials and water-reactive solids and liquids shall be of liquid-tight, noncombustible construction.

415.5.2 Waterproof Room. Rooms or areas used for the storage of water-reactive solids and liquids shall be constructed in a manner that resists the penetration of water through the use of waterproof materials. Piping carrying water for other than approved automatic fire sprinkler systems shall not be within such rooms or areas.

415.6 Smoke and Heat Venting. Smoke and heat vents complying with 780 CMR 910.0 shall be installed in the following locations:

1. In occupancies classified as Group H-2 or H-3, any of which are over 15,000 square feet (1394 m^2) in single floor area.

Exception. Buildings of noncombustible construction containing only noncombustible materials.

2. In areas of buildings in Group H used for storing Class 2, 3 and 4 liquid and solid oxidizers, Class 1 and unclassified detonable organic peroxides, Class 3 and 4 unstable (reactive) materials, or Class 2 or 3 water-reactive materials as required for a Class V hazard classification.

Exception: Buildings of noncombustible construction containing only noncombustible materials.

415.7 Group H-2. Occupancies in Group H-2 shall be constructed in accordance with 780 CMR 415.7.1 through 415.7.4 and the International Fire Code. Note that 527 CMR likewise regulates in this field.

415.7.1 Combustible Dusts, Grain Processing and Storage. The provisions of 780 CMR 415.7.1.1 through 415.7.1.5 shall apply to buildings in which materials that produce combustible dusts are stored or handled. Buildings that store or handle combustible dusts shall comply with the applicable provisions of NFPA 61, NFPA 120, NFPA 651, NFPA 654, NFPA 655, NFPA 664 and NFPA 85, and the *International Fire Code*.

415.7.1.1 Type of Construction and Height Exceptions. Buildings shall be constructed in compliance with the height and area limitations of Table 503 for Group H-2; except that where erected of Type I or II construction, the heights and areas of grain elevators and similar structures shall be unlimited, and where of Type IV construction, the maximum height shall be 65 feet (19 812 mm) and except further that, in isolated areas, the maximum height of Type IV structures shall be increased to 85 feet (25 908 mm).

415.7.1.2 Grinding Rooms. Every room or space occupied for grinding or other operations that produce combustible dusts shall be enclosed with fire barriers and horizontal assemblies or both that have not less than a two-hour fire-resistance rating where the area is not more than 3,000 square feet (279 m^2), and not less than a four-hour fire-resistance rating where the area is greater than 3,000 square feet (279 m^2).

415.7.1.3 Conveyors. Conveyors, chutes, piping and similar equipment passing through the enclosures of rooms or spaces shall be constructed dirt tight and vapor tight, and be of approved noncombustible materials complying with 780 CMR 30.00.

415.7.1.4 Explosion Control. Explosion control shall be provided as specified in the *International Fire Code*, or spaces shall be equipped with the equivalent mechanical ventilation complying with the *International Mechanical Code*.

415.7.1.5 Grain Elevators. Grain elevators, malt houses and buildings for similar occupancies shall not be located within 30 feet (9144 mm) of interior lot lines or structures on the same lot, except where erected along a railroad right-of-way.

415.7.1.6 Coal Pockets. Coal pockets located less than 30 feet (9144 mm) from interior lot lines or from structures on the same lot shall be constructed of not less than Type IB construction. Where more than 30 feet (9144 mm) from interior lot lines, or where erected along a railroad right-of-way, the minimum type of construction of such structures not more than 65 feet (19 812 mm) in height shall be Type IV.

415.7.2 Flammable and Combustible Liquids. The storage, handling, processing and transporting of flammable and combustible liquids shall be in accordance with the International Mechanical Code and the International Fire Code, additionally 527 CMR regulates in this field.

415.7.2.1 Mixed Occupancies. Where the storage tank area is located in a building of two or more occupancies, and the quantity of liquid exceeds the maximum allowable quantity for one control area, the use shall be completely separated from adjacent fire areas in accordance with the requirements of 780 CMR 302.3.2.

415.7.2.1.1 Height Exception. Where storage tanks are located within only a single-story building, the height limitation of 780 CMR 503.0 shall not apply for Group H.

415.7.2.2 Tank Protection. See 527 CMR.

415.7.2.3 Tanks. See 527 CMR.

415.7.2.4 Suppression. Group H shall be equipped throughout with an approved automatic sprinkler system, installed in accordance with 780 CMR 903.0.

415.7.2.5 Leakage Containment. See 527 CMR.

415.7.2.6 Leakage Alarm. An approved automatic alarm shall be provided to indicate a leak in a storage tank and room. The alarm shall sound an audible signal, 15 dBa above the ambient sound level, at every point of entry into the room in which the leaking storage tank is located. An approved sign shall be posted on every entry door to the tank storage room indicating the potential hazard of the interior room environment, or the sign shall state: WARNING, WHEN ALARM SOUNDS, THE ENVIRONMENT WITHIN THE ROOM MAY BE HAZARDOUS. The leakage alarm shall also be supervised in accordance with 780 CMR 9.00 to transmit a trouble signal.

415.7.2.7 Tank Vent. See 527 CMR.

415.7.2.8 Room Ventilation. Storage tank areas storing Class I, II or IIIA liquids shall be provided with mechanical ventilation. The mechanical ventilation system shall be in accordance with the *International Mechanical Code* and the *International Fire Code*.

415.7.2.9 Explosion Venting. Where Class I liquids are being stored, explosion venting shall be provided in accordance with the *International Fire Code*.

415.7.2.10 Tank Openings Other than Vents. See 527 CMR.

415.7.3 Liquefied Petroleum Gas-distribution Facilities. See 527 CMR.

415.7.3.1 Air movement. See 527 CMR.

415.7.3.2 Construction. Liquefied petroleum gas-distribution facilities shall be constructed in accordance with 780 CMR 415.7.3.3 for separate buildings, 780 CMR 415.7.3.4 for attached buildings or 780 CMR 415.7.3.5 for rooms within buildings.

415.7.3.3 Separate Buildings. Where located in separate buildings, liquefied petroleum gas-distribution facilities shall be occupied exclusively for that purpose or for other purposes having similar hazards. Such buildings shall be limited to one story in height and shall conform to 780 CMR 415.7.3.3.1 through 415.7.3.3.3.

415.7.3.3.1 Floors. The floor shall not be located below ground level and any spaces beneath the floor shall be solidly filled or shall be unenclosed.

415.7.3.3.2 Materials. Walls, floors, ceilings, <->columns and roofs shall be constructed of noncombustible materials.

415.7.3.3.3 Explosion Venting. Explosion venting shall be provided in accordance with the *International Fire Code*.

415.7.3.4 Attached Buildings. Where liquefied petroleum gas-distribution facilities are located in an attached structure, the attached perimeter shall not exceed 50% of the perimeter of the space enclosed and the facility shall comply with 780 CMR 415.7.3.3 and 415.7.3.4.1. Where the attached perimeter exceeds 50%, such facilities shall comply with 780 CMR 415.7.3.5.

415.7.3.4.1 Fire Separation Assemblies. Separation of the attached structures shall be provided by fire barrier walls and horizontal assemblies, or both, having a fire-resistance rating of not less than one hour and shall not have openings. Fire barrier walls and horizontal assemblies, or both, between attached structures occupied only for the storage of LP-gas are permitted to have fire doors that comply with 780 CMR 715.0. Such fire barrier walls and horizontal assemblies, or both, shall be designed to withstand a static pressure of at least 100 pounds per square foot (psf) (4788 Pa), except where the building to which the structure is attached is occupied by operations or processes having a similar hazard.

415.7.3.5 Rooms within Buildings. Where liquefied petroleum gas-distribution facilities are located in rooms within buildings, such rooms shall be located in the first story above grade plane and shall have at least one exterior wall with sufficient exposed area to provide explosion venting as required in the *International Fire Code*. The building in which the room is located shall not have a basement or unventilated crawl space and the room shall comply with 780 CMR 415.7.3.5.1 and 415.7.3.5.2.

415.7.3.5.1 Materials. Walls, floors, ceilings and roofs of such rooms shall be constructed of approved noncombustible materials.

415.7.3.5.2 Common Construction. Walls and floor/ceiling assemblies common to the room and to the building within which the room is located shall have a fire barrier wall and horizontal assembly or both of not less than a one-hour fire-resistance rating and without openings. Common walls for rooms occupied only for storage of LP-gas are permitted to have opening protectives complying with 780 CMR 715. Such walls and ceiling shall be designed to withstand a static pressure of at least 100 psf (4788 Pa).

Exception: Where the building, within which the room is located, is occupied by operations or processes having a similar hazard.

415.7.4 Dry Cleaning Plants. See 527 CMR.

415.8 Groups H-3 and H-4. Groups H-3 and H-4 shall be constructed in accordance with the applicable provisions of 780 CMR and the *International Fire Code*.

415.8.1 Gas Rooms. When gas rooms are provided, such rooms shall be separated from other areas by not less than a 1-hour fire barrier.

415.8.2 Floors in Storage Rooms. Floors in storage areas for corrosive liquids and highly toxic or toxic materials shall be of liquid-tight, noncombustible construction.

415.8.3 Separation—Highly Toxic Solids and Liquids. Highly toxic solids and liquids not stored in approved hazardous materials storage cabinets shall be isolated from other hazardous materials storage by construction having a 1-hour fire-resistance rating.

415.9 Group H-5.

415.9.1 General. In addition to the requirements set forth elsewhere in 780 CMR, Group H-5 shall comply with the provisions of 780 CMR 415.9 and the *International Fire Code*.

415.9.2 Fabrication Areas.

415.9.2.1 Hazardous Materials in Fabrication Areas.

415.9.2.1.1 Aggregate Quantities. The aggregate quantities of hazardous materials stored and used in a single fabrication area shall not exceed the quantities set forth in Table 415.9.2.1.1.

Exception. The quantity limitations for any hazard category in Table 415.9.2.1.1 shall not apply where the fabrication area contains quantities of hazardous materials not exceeding the maximum allowable quantities per control area established by Tables 307.7(1) and 307.7(2).

TABLE 415.9.2.1.1 QUANTITY LIMITS FOR HAZARDOUS MATERIALS IN A SINGLE FABRICATION AREA IN GROUP H-5

HAZARD CATEGORY		SOLIDS (pounds per square feet)	LIQUIDS (gallons per square feet)	GAS (feet^3 @ NTP/square feet)
PHYSICAL-HAZARD MATERIALS				
Combustible dust		Note b	Not Applicable	Not Applicable
Combustible fiber	Loose	Note b	Not Applicable	Not Applicable
	Baled	Note b		
Combustible liquid	II	Not Applicable	0.01	Not Applicable
	IIIA		0.02	
	IIIB		Not Limited	
Combination Class I, II and IIIA			0.04	
Cryogenic gas	Flammable	Not Applicable	Not Applicable	Note c
	Oxidizing			1.25
Explosives		Note b	Note b	Note b
Flammable gas	Gaseous	Not Applicable	Not Applicable	Note c Note c
	Liquefied			
Flammable liquid	IA	Not Applicable	0.0025	Not Applicable
	IB		0.025	
	IC		0.025	
Combination Class IA, IB and IC			0.025	
Combination Class I, II and IIIA			0.04	
Flammable solid		0.001	Not Applicable	Not Applicable
Organic peroxide			Not Applicable	Not Applicable
Unclassified detonable		Note b		
	Class I	Note b		
	Class II	0.025		
	Class III	0.1		
	Class IV	Not Limited		
	Class V	Not limited		
Oxidizing gas	Gaseous	Not Applicable	Not Applicable	1.25
	Liquefied			1.25
Combination of gaseous and liquefied				1.25
Oxidizer	Class 4	Note b	Note b	Not Applicable
	Class 3	0.003	0.003	
	Class 2	0.003	0.003	
	Class 1	0.003	0.003	
Combination	Class 1, 2, 3	0.003	0.003	
Pyrophoric material		Note b	0.00125	Notes c and d
Unstable reactive	Class 4	Note b	Note b	Note b
	Class 3	0.025	0.0025	Note b
	Class 2	0.1	0.01	Note b
	Class 1	Not Limited	Not Limited	Not Limited
Water reactive	Class 3	Note b	0.00125	Not Applicable
	Class 2	0.25	0.025	
	Class 1	Not Limited	Not Limited	
HEALTH-HAZARD MATERIALS				
Corrosives		Not Limited	Not Limited	Not Limited
Highly toxic		Not Limited	Not Limited	Note c
Toxics		Not Limited	Not Limited	Note c

For SI: 1 pound per square foot = 4.882 kg/m^2, 1 gallon per square foot = 0.025 L/m^2, 1 cubic foot @ NTP/square foot = 0.305 M^3 @ NTP/m^2, 1 cubic foot = 0.02832 M^3.

a. Hazardous materials within piping shall not be included in the calculated quantities.

b. Quantity of hazardous materials in a single fabrication shall not exceed the maximum allowable quantities per control area in Tables 307.7(1) and 307.7(2).

c. The aggregate quantity of flammable, pyrophoric, toxic and highly toxic gases shall not exceed 9,000 cubic feet at NTP.

d, The aggregate quantity of pyrophoric gases in the building shall not exceed the amounts set forth in Table 415.3.2.

415.9.2.1.2 Hazardous Production Materials. The maximum quantities of hazardous production materials stored in a single fabrication area shall not exceed the maximum allowable quantities per control area established by Tables 307.7(1) and 307.7(2).

415.9.2.2 Separation. Fabrication areas, whose sizes are limited by the quantity of hazardous materials allowed by Table 415.9.2.1.1, shall be separated from each other, from exit access corridors, and from other parts of the building by not less than 1-hour fire barriers.

Exceptions:.

1. Doors within such fire barrier walls, including doors to corridors, shall be only self-closing fire assemblies having a fire-protection rating of not less than ¾ hour.
2. Windows between fabrication areas and

exit access corridors are permitted to be fixed glazing listed and labeled for a fire protection rating of at least ¾ hour in accordance with 780 CMR 715.0.

415.9.2.3 Location of Occupied Levels. Occupied levels of fabrication areas shall be located at or above the first story above grade plane.

415.9.2.4 Floors. Except for surfacing, floors within fabrication areas shall be of noncombustible construction.

Openings through floors of fabrication areas are permitted to be unprotected where the interconnected levels are used solely for mechanical equipment directly related to such fabrication areas (see also 780 CMR 415.9.2.5).

Floors forming a part of an occupancy separation shall be liquid tight.

415.9.2.5 Shafts and Openings Through Floors. Elevator shafts, vent shafts and other openings through floors shall be enclosed when required by 780 CMR 707.0. Mechanical, duct and piping penetrations within a fabrication area shall not extend through more than two floors. The annular space around penetrations for cables, cable trays, tubing, piping, conduit or ducts shall be sealed at the floor level to restrict the movement of air. The fabrication area, including the areas through which the ductwork and piping extend, shall be considered a single conditioned environment.

415.9.2.6 Ventilation. Mechanical exhaust ventilation shall be provided throughout the fabrication area at the rate of not less than 1 cubic foot per minute per square foot (0.044 L/S/m^2) of floor area. The exhaust air duct system of one fabrication area shall not connect to another duct system outside that fabrication area within the building.

A ventilation system shall be provided to capture and exhaust fumes and vapors at workstations.

Two or more operations at a workstation shall not be connected to the same exhaust system where either one or the combination of the substances removed could constitute a fire, explosion or hazardous chemical reaction within the exhaust duct system.

Exhaust ducts penetrating occupancy separations shall be contained in a shaft of equivalent fire-resistance construction. Exhaust ducts shall not penetrate fire walls.

Fire dampers shall not be installed in exhaust ducts.

***415.9.2.7 Transporting Hazardous Production Materials to Fabrication Areas.** Hazardous production materials shall be transported to fabrication areas through enclosed piping or tubing systems that comply with 780 CMR 415.9.6.1, through service corridors complying with 780 CMR 415.9.4, or in exit access corridors as permitted in the exception to 780 CMR 415.9.3. The handling or transporting of hazardous production materials within service corridors shall comply with the Massachusetts Fire Prevention Regulations (527 CMR).*

415.9.2.8 Electrical.

415.9.2.8.1 General. Electrical equipment and devices within the fabrication area shall comply with *527 CMR*. The requirements for hazardous locations need not be applied where the average air change is at least four times that set forth in 780 CMR 415.9.2.6 and where the number of air changes at any location is not less than three times that required by 780 CMR 415.9.2.6. The use of recirculated air shall be permitted.

415.9.2.8.2 Workstations. Workstations shall not be energized without adequate exhaust ventilation. See 780 CMR 415.9.2.6 for workstation exhaust ventilation requirements.

415.9.3 Exit access Corridors. Exit access corridors shall comply with Chapter 10 and shall be separated from fabrication areas as specified in 780 CMR 415.9.2.2. Exit access corridors shall not contain HPM and shall not be used for transporting such materials, except through closed piping systems as provided in 780 CMR 415.9.6.3.

Exception. Where existing fabrication areas are altered or modified, HPM is allowed to be transported in existing exit access corridors, subject to the following conditions:

1. **Corridors.** Exit access corridors adjacent to the fabrication area where the alteration work is to be done shall comply with 780 CMR 1016 for a length determined as follows:
   1.1. The length of the common wall of the corridor and the fabrication area; and
   1.2. For the distance along the exit access corridor to the point of entry of HPM into the exit access corridor serving that fabrication area.
2. **Emergency Alarm System.** There shall be an emergency telephone system, a local manual alarm station or other approved alarm-initiating device within exit access corridors at not more than 150-foot (45 720 mm) intervals and at each exit and exit access doorway. The signal shall be relayed to an approved central, proprietary or remote station service or the emergency control station and shall also initiate a local audible alarm.

3. **Pass-throughs**. Self-closing doors having a fire-protection rating of not less than one hour shall separate pass-throughs from existing exit access corridors. Pass-throughs shall be constructed as required for the exit access corridors, and protected by an approved automatic fire-extinguishing system.

415.9.4 Service Corridors.

415.9.4.1 Occupancy. Service corridors shall be classified as Group H-5.

415.9.4.2 Use Conditions. Service corridors shall be separated from exit access corridors as required by 780 CMR 415.9.2.2. Service corridors shall not be used as a required exit access corridor.

415.9.4.3 Mechanical Ventilation. Service corridors shall be mechanically ventilated as required by 780 CMR 415.9.2.6 or at not less than six air changes per hour, whichever is greater.

415.9.4.4 Means of Egress. The maximum distance of travel from any point in a service corridor to an exit, exit access corridor or door into a fabrication area shall not exceed 75 feet (22 860 mm). Dead ends shall not exceed four feet (1219 mm) in length. There shall be not less than two exits, and not more than ½ of the required means of egress shall require travel into a fabrication area. Doors from service corridors shall swing in the direction of egress travel and shall be self-closing.

415.9.4.5 Minimum Width. The minimum clear width of a service corridor shall be five feet (1524 mm), or 33 inches (838 mm) wider than the widest cart or truck used in the corridor, whichever is greater.

415.9.4.6 Emergency Alarm System. Emergency alarm systems shall be provided in accordance with 780 CMR 415.0 and 780 CMR 414.7.1 and 414.7.2. The maximum allowable quantity per control area provisions shall not apply to emergency alarm systems required for HPM.

415.9.4.6.1 Service Corridors. An emergency alarm system shall be provided in service corridors, with at least one alarm device in each service corridor.

415.9.4.6.2 Exit Access Corridors and Exit Enclosures. Emergency alarms for exit access corridors and exit enclosures shall comply with 780 CMR 414.7.

415.9.4.6.3 Liquid Storage Rooms, HPM Rooms and Gas Rooms. Emergency alarms for liquid storage rooms, HPM rooms and gas rooms shall comply with 780 CMR 414.7.1.

415.9.4.6.4 Alarm-initiating Devices. An approved emergency telephone system, local alarm manual pull stations, or other approved alarm-initiating devices are allowed to be used as emergency alarm-initiating devices.

415.9.4.6.5 Alarm Signals. Activation of the emergency alarm system shall sound a local alarm and transmit a signal to the emergency control station.

415.9.5 Storage of Hazardous Production Materials.

415.9.5.1 General. Storage of HPM in fabrication areas shall be within approved or listed storage cabinets or gas cabinets, or within a workstation. The storage of hazardous production materials in quantities greater than those listed in Tables 307.7(1) or 307.7(2) shall be in liquid storage rooms, HPM rooms or gas rooms as appropriate for the materials stored. The storage of other hazardous materials shall be in accordance with other applicable provisions of 780 CMR, the International Fire Code and 527 CMR.

415.9.5.2 Construction.

415.9.5.2.1 HPM Rooms and Gas Rooms. HPM rooms and gas rooms shall be separated from other areas by not less than a two-hour fire barrier where the area is 300 square feet (27.9 m^2) or more and not less than a one-hour fire barrier where the area is less than 300 square feet (27.9 m^2).

415.9.5.2.2 Liquid Storage Rooms. Liquid storage rooms shall be constructed in accordance with the following requirements:

1. Rooms in excess of 500 square feet (46.5 m^2) shall have at least one exterior door approved for fire department access.
2. Rooms shall be separated from other areas by fire barriers having a fire-resistance rating of not less than one-hour for rooms up to 150 square feet (13.9 m^2) in area and not less than two hours where the room is more than 150 square feet (13.9 m^2) in area.
3. Shelving, racks and wainscoting in such areas shall be of noncombustible construction or wood of not less than one inch (25 mm) nominal thickness.
4. Rooms used for the storage of Class I flammable liquids shall not be located in a basement.

415.9.5.2.3 Floors. Except for surfacing, floors of HPM rooms and liquid storage rooms shall be of noncombustible liquid-tight construction. Raised grating over floors shall be of noncombustible materials.

415.9.5.3 Location. Where HPM rooms, liquid storage rooms and gas rooms are provided, they shall have at least one exterior wall and such wall shall be not less than 30 feet (9144 mm) from property lines, including property lines adjacent to public ways.

415.9.5.4 Explosion Control. Explosion control shall be provided where required by 780 CMR 414.5.1.

415.9.5.5 Exits. Where two exits are required from HPM rooms, liquid storage rooms and gas rooms, one shall be directly to the outside of the building.

415.9.5.6 Doors. Doors in a fire barrier wall, including doors to corridors, shall be self-closing fire assemblies having a fire-protection rating of not less than ¾ hour.

415.9.5.7 Ventilation. Mechanical exhaust ventilation shall be provided in liquid storage rooms, HPM rooms and gas rooms at the rate of not less than one cubic foot per minute per square foot (0.044 L/S/m2) of floor area or six air changes per hour, whichever is greater, for categories of material.

Exhaust ventilation for gas rooms shall be designed to operate at a negative pressure in relation to the surrounding areas and direct the exhaust ventilation to an exhaust system.

415.9.5.8 Emergency Alarm System. An approved emergency alarm system shall be provided for HPM rooms, liquid storage rooms and gas rooms.

Emergency alarm-initiating devices shall be installed outside of each interior exit door of such rooms.

Activation of an emergency alarm-initiating device shall sound a local alarm and transmit a signal to the emergency control station.

An approved emergency telephone system, local alarm manual pull stations or other approved alarm-initiating devices are allowed to be used as emergency alarm-initiating devices.

415.9.6 Piping and Tubing.

415.9.6.1 General. Hazardous production materials piping and tubing shall comply with 780 CMR 415.0 and ANSI B31.3.

415.9.6.2 Supply Piping and Tubing.

415.9.6.2.1 HPM Having a Health-hazard Ranking of 3 or 4. Systems supplying HPM liquids or gases having a health-hazard ranking of 3 or 4 shall be welded throughout, except for connections, to the systems that are within a ventilated enclosure if the material is a gas, or an approved method of drainage or containment is provided for the connections if the material is a liquid.

415.9.6.2.2 Location in Service Corridors. Hazardous production materials supply piping or tubing in service corridors shall be exposed to view.

415.9.6.2.3 Excess Flow Control. Where HPM gases or liquids are carried in pressurized piping above 15 pounds per square inch gauge (psig) (103.4 kPa), excess flow control shall be provided. Where the piping originates from within a liquid storage room, HPM room or gas room, the excess flow control shall be located within the liquid storage room, HPM room or gas room. Where the piping originates from a bulk source, the excess flow control shall be located as close to the bulk source as practical.

415.9.6.3 Installations in Exit Access Corridors and above Other Occupancies. The installation of hazardous production material piping and tubing within the space defined by the walls of exit access corridors and the floor or roof above or in concealed spaces above other occupancies shall be in accordance with 780 CMR 415.9.6.2 and the following conditions:

1. Automatic sprinklers shall be installed within the space unless the space is less than six inches (152 mm) in the least dimension.
2. Ventilation not less than six air changes per hour shall be provided. The space shall not be used to convey air from any other area.
3. Where the piping or tubing is used to transport HPM liquids, a receptor shall be installed below such piping or tubing. The receptor shall be designed to collect any discharge or leakage and drain it to an approved location. The one-hour enclosure shall not be used as part of the receptor.
4. HPM supply piping and tubing and HPM nonmetallic waste lines shall be separated from the exit access corridor and from occupancies other than Group H-5 by construction as required for walls or partitions that have a fire protection rating of not less than one hour. Where gypsum wallboard is used, joints on the piping side of the enclosure are not required to be taped, provided the joints occur over framing members. Access openings into the enclosure shall be protected by approved fire-resistance-rated assemblies.
5. Readily accessible manual or automatic remotely activated fail-safe emergency shutoff valves shall be installed on piping and tubing other than waste lines at the following locations:
   5.1. At branch connections into the fabrication area.
   5.2. At entries into exit access corridors.

Exception: Transverse crossings of the corridors by supply piping that is enclosed within a ferrous pipe or tube for the width of corridor need not comply with 780 CMR 415.9.6.3 Items 1. through 5.

415.9.6.4 Identification. Piping, tubing and HPM waste lines shall be identified in accordance with ANSI A13.1 to indicate the material being transported.

415.9.7 Continuous Gas-detection Systems. A continuous gas-detection system shall be provided for HPM gases when the physiological warning properties of the gas are at a higher level than the accepted permissible exposure limit (PEL) for the gas and for flammable gases in accordance with 780 CMR 415.0.

415.9.7.1 Where Required. A continuous gas-detection system shall be provided in the areas identified in 780 CMR 415.9.7.1.1 through 415.9.7.1.4.

415.9.7.1.1 Fabrication Areas. A continuous gas-detection system shall be provided in fabrication areas when gas is used in the fabrication area.

415.9.7.1.2 HPM Rooms. A continuous gas-detection system shall be provided in HPM rooms when gas is used in the room.

415.9.7.1.3 Gas Cabinets, Exhausted Enclosures and Gas Rooms. A continuous gas-detection system shall be provided in gas cabinets and exhausted enclosures. A continuous gas-detection system shall be provided in gas rooms when gases are not located in gas cabinets or exhausted enclosures.

415.9.7.1.4 Exit Access Corridors. When gases are transported in piping placed within the space defined by the walls of an exit access corridor, and the floor or roof above the exit access corridor, a continuous gas-detection system shall be provided where piping is located and in the exit access corridor.

Exception. A continuous gas-detection system is not required for occasional transverse crossings of the corridors by supply piping that is enclosed in a ferrous pipe or tube for the width of the corridor.

415.9.7.2 Gas-detection System Operation. The continuous gas-detection system shall be capable of monitoring the room, area or equipment in which the gas is located at or below the PEL or ceiling limit of the gas for which detection is provided. For flammable gases, the monitoring detection threshold level shall be vapor concentrations in excess of 20% of the lower explosive limit (LFL). Monitoring for highly toxic and toxic gases shall also comply with the requirements for such material in the *International Fire Code*.

415.9.7.2.1 Alarms. The gas detection system shall initiate a local alarm and transmit a signal to the emergency control station when a short-term hazard condition is detected. The alarm shall be both visual and audible and shall provide warning both inside and outside the area where the gas is detected. The audible alarm shall be distinct from all other alarms.

415.9.7.2.2 Shutoff of Gas Supply. The gas detection system shall automatically close the shutoff valve at the source on gas supply piping and tubing related to the system being monitored for which gas is detected when a short-term hazard condition is detected. Automatic closure of shutoff valves shall comply with the following:

1. Where the gas-detection sampling point initiating the gas detection system alarm is within a gas cabinet or exhausted enclosure, the shutoff valve in the gas cabinet or exhausted enclosure for the specific gas detected shall automatically close.
2. Where the gas-detection sampling point initiating the gas detection system alarm is within a room and compressed gas containers are not in gas cabinets or an exhausted enclosure, the shutoff valves on all gas lines for the specific gas detected shall automatically close.
3. Where the gas-detection sampling point initiating the gas detection system alarm is within a piping distribution manifold enclosure, the shutoff valve supplying the manifold for the compressed gas container of the specific gas detected shall automatically close.

Exception. Where the gas-detection sampling point initiating the gas detection system alarm is at the use location or within a gas valve enclosure of a branch line downstream of a piping distribution manifold, the shutoff valve for the branch line located in the piping distribution manifold enclosure shall automatically close.

415.9.8 Manual Fire Alarm System. An approved manual fire alarm system shall be provided throughout buildings containing Group H-5. Activation of the alarm system shall initiate a local alarm and transmit a signal to the emergency control station. The fire alarm system shall be designed and installed in accordance with 780 CMR 907.0.

415.9.9 Emergency Control Station. An emergency control station shall be provided on the premises at an approved location, outside of the fabrication area and shall be continuously staffed by trained personnel. The emergency control station shall receive signals from emergency equipment and alarm and detection systems. Such emergency equipment and alarm and detection systems shall include, but not necessarily be limited to, the following where such equipment or systems are required to be provided either in 780 CMR 415.9 or elsewhere in 780 CMR:

1. Automatic fire sprinkler system alarm and monitoring systems.
2. Manual fire alarm systems.
3. Emergency alarm systems.
4. Continuous gas-detection systems.
5. Smoke detection systems.
6. Emergency power system.

415.9.10 Emergency Power System. An emergency power system shall be provided in Group H-5 occupancies where required in 780 CMR 415.9.10.1. The emergency power system shall be designed to supply power automatically to required electrical systems when the normal electrical supply system is interrupted.

415.9.10.1 Where Required. Emergency power shall be provided for electrically operated equipment and connected control circuits for the following systems:

1. HPM exhaust ventilation systems.
2. HPM gas cabinet ventilation systems.
3. HPM exhausted enclosure ventilation systems.
4. HPM gas room ventilation systems.
5. HPM gas detection systems.
6. Emergency alarm systems.
7. Manual fire alarm systems.
8. Automatic sprinkler system monitoring and alarm systems.
9. Electrically operated systems required elsewhere in 780 CMR applicable to the use, storage or handling of HPM.

415.9.10.2 Exhaust Ventilation Systems. Exhaust ventilation systems are allowed to be designed to operate at not less than one-half the normal fan speed on the emergency power system where it is demonstrated that the level of exhaust will maintain a safe atmosphere.

415.9.11 Fire Sprinkler System Protection in Exhaust Ducts for HPM.

415.9.11.1 General. Automatic fire sprinkler system protection shall be provided in exhaust ducts conveying vapors, fumes, mists or dusts generated from HPM in accordance with 780 CMR 415.0 and the *International Mechanical Code*.

415.9.11.2 Metallic and Noncombustible, Nonmetallic Exhaust Ducts. Automatic fire sprinkler system protection shall be provided in metallic and noncombustible, nonmetallic exhaust ducts where all of the following conditions apply:

1. Where the largest cross-sectional diameter is equal to or greater than 10 inches (254 mm).
2. The ducts are within the building.
3. The ducts are conveying flammable vapors or fumes.

415.9.11.3 Combustible Nonmetallic Exhaust Ducts. Automatic fire sprinkler system protection shall be provided in combustible nonmetallic exhaust ducts where the largest cross-sectional diameter of the duct is equal to or greater than ten inches (254 mm).

Exceptions:

1. Ducts listed or approved for applications without automatic fire sprinkler system protection.
2. Ducts not more than 12 feet (3658 mm) in length installed below ceiling level.

415.9.11.4 Automatic Sprinkler Locations. Sprinkler systems shall be installed at 12-foot (3658 mm) intervals in horizontal ducts and at changes in direction. In vertical ducts, sprinklers shall be installed at the top and at alternate floor levels.

[F] 780 CMR 416.0 APPLICATION OF FLAMMABLE FINISHES

416.1 General. The provisions of 780 CMR 416.0 shall apply to the construction, installation and use of buildings and structures, or parts thereof, for the spraying of flammable paints, varnishes and lacquers or other flammable materials or mixtures or compounds used for painting, varnishing, staining or similar purposes. Such construction and equipment shall comply with the *International Fire Code*.

416.2 Spray Rooms. Spray rooms shall be enclosed with fire barrier walls and horizontal assemblies or both with not less than a one-hour fire-resistance rating. Floors shall be waterproofed and drained in an approved manner.

416.2.1 Surfaces. The interior surfaces of spray rooms shall be smooth and shall be so constructed to permit the free passage of exhaust air from all parts of the interior and to facilitate washing and cleaning, and shall be so designed to confine residues within the room. Aluminum shall not be used.

416.3 Spraying Spaces. Spraying spaces shall be ventilated with an exhaust system to prevent the accumulation of flammable mist or vapors in accordance with the *International Mechanical Code*. Where such spaces are not separately enclosed, noncombustible spray curtains shall be provided to restrict the spread of flammable vapors.

416.3.1 Surfaces. The interior surfaces of spraying spaces shall be smooth and continuous without edges, and shall be so constructed to permit the free passage of exhaust air from all parts of the interior and to facilitate washing and cleaning, and shall be so designed to confine residues within the spraying space. Aluminum shall not be used.

416.4 Fire Protection. An automatic fire-extinguishing system shall be provided in all spray, dip and immersing spaces and storage rooms, and shall be installed in accordance with 780 CMR 9.00.

[F] 780 CMR 417.0 DRYING ROOMS

417.1 General. A drying room or dry kiln installed within a building shall be constructed entirely of approved noncombustible materials or assemblies of such materials regulated by the approved rules or as required in the general and specific sections of 780 CMR 4.00 for special occupancies and where applicable to the general requirements of 780 CMR 28.00.

417.2 Piping Clearance. Overhead heating pipes shall have a clearance of not less than two inches (51 mm) from combustible contents in the dryer.

417.3 Insulation. Where the operating temperature of the dryer is 175°F (79°C) or more, metal enclosures shall be insulated from adjacent combustible materials by not less than 12 inches (305 mm) of airspace, or the metal walls shall be lined with ¼-inch (6.35 mm) insulating mill board or other approved equivalent insulation.

417.4 Fire Protection. Drying rooms designed for high-hazard materials and processes, including special occupancies as provided for in 780 CMR 4.00, shall be protected by an approved automatic fire-extinguishing system conforming to the provisions of 780 CMR 9.00.

[F] 780 CMR 418. ORGANIC COATINGS

418.1 Building Features. Manufacturing of organic coatings shall be done only in buildings that do not have pits or basements.

418.2 Location. Organic coating manufacturing operations and operations incidental to or connected therewith shall not be located in buildings having other occupancies.

418.3 Process Mills. Mills operating with close clearances and that process flammable and heat-sensitive materials, such as nitrocellulose, shall be located in a detached building or noncombustible structure.

418.4 Tank Storage. Storage areas for flammable and combustible liquid tanks inside of structures shall be located at or above grade and shall be separated from the processing area by not less than two-hour fire-resistance-rated fire barriers.

418.5 Nitrocellulose Storage. Nitrocellulose storage shall be located on a detached pad or in a separate structure or a room enclosed with no less than two-hour fire-resistance-rated fire barriers.

418.6 Finished Products. Storage rooms for finished products that are flammable or combustible liquids shall be separated from the processing area by fire barriers having a fire-resistance rating of at least two hours, and openings in the walls shall be protected with approved opening protectives.

780 CMR 419.0 MOBILE UNITS

419.1 For regulations pertaining to Mobile Units, see 780 CMR 35, and 780 CMR 110.R3.

780 CMR 420.0 SWIMMING POOLS

420.1 General. See Appendix 120.M.

780 CMR 421.0 GROUP RESIDENCE

421.1 Scope*. Except as may otherwise be specifically provided for in 780 CMR 421.0, the requirements of 780 CMR, in its entirety, and as applicable, shall apply.*

> ***421.1.1 Department of Mental Retardation (DMR) Group Homes****. 780 CMR 421.0 shall not apply to premises operated or licensed by the Department of Mental Retardation (DMR) pursuant to 115 CMR 7.00 and 8.00, upon the completion of a DMR safety assessment for each individual and an approved safety plan for each location where services and supports are provided. Such premises shall be treated as conventional R-4, R-3, R-2 and R-1 use as applicable.*

421.2 Definition. A group residence is a premise licensed by or operated by an agency of the Commonwealth of Massachusetts or subdivision thereof, as a special residence for those who are capable of self-preservation in the categories listed in 780 CMR 421.2 Items 1. through 3.:

1. not more than 12 unrelated persons between the ages of seven through 15 years of age; or
2. not more than 25 unrelated persons, 16 years of age or older; or
3. a combination of 780 CMR 423.2 Items 1. and 2. consisting of not more than 18 unrelated persons over seven years of age calculated at the rate of two such persons, or portion thereof, from Item 2. being equal to one such person in Item 1. all in accordance with Table 421.2.

> ***Note: In determining the classification for proposed use, group residence shall not be construed as being similar in any way to a multifamily dwelling, two-family dwelling, boarding house, lodging house, dormitory, hotel, school or institution of any kind. For the purposes of 780 CMR, it shall be treated as a single-family residential building.***

TABLE 421.2 GROUP RESIDENCE - MAXIMUM CAPACITY, COMBINATION OF CATEGORIES

Category Number	*Number of Residents per Category*												
Category 1	*12*	*11*	*10*	*9*	*8*	*7*	*6*	*5*	*4*	*3*	*2*	*1*	*0*
Category 2	*0*	*2*	*4*	*6*	*8*	*10*	*12*	*13*	*14*	*15*	*16*	*17*	*25*
Maximum total residents	*12*	*13*	*14*	*15*	*16*	*17*	*18*	*18*	*18*	*18*	*18*	*18*	*25*

421.2.1 Special Definitions*. For the purpose of 780 CMR 421.0, the following terms shall be defined exclusively for use with group residences:*

Authorized Inspectors*. The state or local building official having jurisdiction and a representative of the licensing or operating agency having jurisdiction.*

Egress*.: A continuous unobstructed path of travel from any space in a building to the open air outside at grade.*

Escape Route. To reduce the possibility of entrapment in the event that the principal means of egress is blocked by fire or smoke, an escape route shall be available which performs in accordance with 780 CMR 421.6 and 421.9. In an existing building where a second means of egress is physically impractical from above grade floors, any proven, usable path to the open air outside at grade shall be deemed acceptable, including but not limited to connecting doors, porches, windows within six feet of grade, ramps, fire escapes, balcony evacuation systems, etc.

Principal Means of Egress*. The primary choice of two routes normally used by occupants to enter or leave a building.*

Room*. See definition of "Habitable space" and "Occupiable room" in 780 CMR 201.0.*

Self Preservation*. Having the capability, both mentally and physically, to take action to preserve one's own life. Specifically, to egress the building within 2½ minutes. (Reference inspection procedures in 780 CMR 421.8 and 421.9.)*

421.3 Existing Buildings*. The requirements of 780 CMR 421.0, shall also apply to existing dwelling units which are to be converted to a group residence and alternative requirements set forth in 780 CMR 34.00 that conflict with the requirements of 780 CMR 421.0 shall not apply.*

421.3.1 Height Limitations*. Existing buildings, of Type 5B construction, greater than 2½ stories, or 35 feet in height may be allowed to be used (as an exception to Table 503) as a group residence.*

421.4 Plans and Specifications*. Plans shall be filed with the building official having jurisdiction in accordance with 780 CMR 110.0 for any building to be constructed as, or altered for use as, a group residence under 780 CMR 421.0. The floor plans shall show all rooms, spaces, closets, doors, corridors, windows, stairs and stairways, hazardous vertical openings and the location of all required fire warning equipment and proposed fire suppression equipment.*

421.5 Hazardous Contents*. Any contents which represent a fire hazard greater than that which could be expected of ordinary household furnishings, shall not be allowed. Storage shall not be allowed above the second floor.*

421.5.1 Interior Finish*. Only Class I and Class II interior finish materials shall be allowed in the principal means of egress. In refinishing any other area, material having a Class III flame spread rating shall be allowed provided it does not decrease the existing rating. The smoke contribution rating of any material shall not exceed 450 (see 780 CMR 704.0).*

421.5.2 Exception*. In existing buildings, the required flame spread or smoke development classification of interior surfaces may be obtained by applying approved fire retardant paints or solutions to existing interior surfaces having a higher flame spread rating than permitted.*

421.6 Egress*. In existing buildings there shall be one means of egress and one escape route serving each floor, remote as possible from each other and leading to grade. The stairway between the first and second floors, if unenclosed, may remain unenclosed to preserve functional and aesthetic requirements. In new construction, two means of egress are required in accordance with the 780 CMR 51.00 through 99.00 (One- and Two-Family Dwelling Code), and stairways above the grade floor shall be enclosed with one hour fireresistive construction.*

Exceptions:

1. Where the Group Residence is protected with a fire suppression system according to NFPA 13D or better as listed in 780 CMR 35.00, only one means of egress shall be required from floors above the grade floor in existing buildings and new construction.

2. Where the Group Residence is protected with a fire suppression system according to NFPA 13D or better as listed in 780 CMR 35.00 the enclosure of stairways is not required.

421.7 Fire Protection Systems.

421.7.1 Hazardous Vertical Openings*. Openings to such spaces as laundry chutes, dumbwaiters, heating plenums or combustible concealed spaces shall be permanently blocked with one hour construction, as regulated by the provisions of 780 CMR 7.00.*

421.7.2 Automatic Fire Warning Systems*. An approved automatic fire warning system shall be provided in accordance with 780 CMR 9.00.*

421.8 Inspections. *There shall be three mandatory types of inspections as described below. The results of such inspections shall be on file in the office of the building official with copies sent to the licensing or operating agency on a prepared checklist and signed by the authorized inspectors.*

421.8.1 Temporary Certificate. *The building official shall perform plan review and post-construction inspection to ensure that the building conforms to 780 CMR. He shall issue a temporary certificate of occupancy effective for 90 days only.*

421.8.2 Final Certificate. *Before issuance of the final certificate of occupancy, the authorized inspectors shall mutually conduct a test (see 780 CMR 421.9.1) to ensure that the occupants are capable of self-preservation. Upon complete satisfaction of all requirements, the building official shall then issue a permanent certificate of occupancy. This test shall be conducted once a year in accordance with 780 CMR 106.5 for purposes of recertifying both the building and the occupants.*

421.9 Inspection Procedure. *The building and the occupants' capability of self-preservation constitute a system of life safety which are unique for each building and for each occupant in a group residence. Therefore, a simple direct test is specified herein to determine the capability of the occupant and/or the suitability of the building as a life safety system.*

421.9.1 Direct Test/Fire Drill. *A fire drill shall be conducted as the direct test required by 780 CMR 421.9. The building official may require that he be present for the fire drill, or may accept an affidavit signed by the residence manager citing the names of the authorized inspectors present, the names of the occupants who participated, the name(s) of any occupants who failed to egress the building within 2½ minutes, the date, time and place where said fire drill was held. During the conduct of the drill, all staff personnel of the group residence shall isolate themselves from the occupants. The authorized inspector(s), when present, shall then cause to be blocked any one point in an egress route where the choice of an alternate route is possible, to simulate a hazardous condition, and the internal alarm system shall be activated for 2½ minutes.*

421.9.2 Evaluation. *Any occupant who fails to escape from the building and achieve egress outside the building at ground level within the 2½ minute period shall not be permitted to remain living in the residence.*

Note: *The occupant or the building may be at fault; therefore, the system has failed to perform adequately to provide life safety and is, consequently, unacceptable for that occupant.*

421.9.3 Other Tests. *Other tests are not necessary and shall not be required by the building official. It shall be the responsibility of the residence manager of the group residence to provide immediate suitable accommodations elsewhere for any occupant deemed unacceptable by the building official. Each occupant must be certified at regular intervals but not less than every quarter at the group residence by the licensing or operating agency. The building official may require an inspection at his discretion when he feels that either the building or the occupant may not conform.*

421.10 Certificate of Occupancy. *Any certificate of occupancy issued for a building intended to be used as a group residence, as defined in 780 CMR 421.2, shall become invalid if the premises have not been licensed or authorized by an agency of the Commonwealth of Massachusetts within 90 days of the date of issuance of the certificate of occupancy.*

780 CMR 422.0 DAY CARE CENTERS

(Note: The specific provisions of 780 CMR 422.0 shall govern when specific provisions and general Code provisions are in conflict)

422.1 General. *Day care centers in new or existing buildings shall be subject to the applicable provisions of 780 CMR and the special requirements of 780 CMR 422.0.*

422.2 Definitions.

Child Day Care Centers. *See 780 CMR 422.0: Day Care Center in conjunction with 780 CMR 422.3.1 and 780 CMR 422.3.2.*

Day Care Center. *Special occupancies in which clients receive care, maintenance, and supervision by other than relatives or legal guardians for less than 24 hours per day. Such day care centers include both child day care centers and adult day care centers licensed by the office for children or other state agencies or otherwise functioning as a day care center.*

Smoke Stop Partition. *For purposes of 780 CMR 422.0, a smoke stop partition shall satisfy the requirements of 780 CMR 710.0 for a Smoke Partition.*

422.3 Use Group Classifications.

422.3.1 Less than Two Years and Nine Months in Age. *Buildings and portions thereof licensed by the Office for Children as child day care centers for children two years and nine months in age or younger shall be classified as I-4 use group.*

422.3.2 More than Two Years and Nine Months in Age. *Buildings or portions thereof licensed by the Office for Children as child day care centers for children more than two years and nine months* *in age shall be classified as E-use group.*

***422.3.3 Adult Day Care Centers**. Buildings or portions thereof licensed by agencies of the state or otherwise operating as day care centers shall be classified as I-4-use. See also 780 CMR 308.5.1.*

***422.4 General Provisions**.*

***422.4.1 Means of Egress**. Day Care Centers in new and existing buildings or portions thereof shall conform to the means of egress requirements as set forth in 780 CMR 10.00 and 780 CMR 34.00 as applicable and otherwise noted in 780 CMR 422.0.*

***422.4.1.1 Exit Signs and Means of Egress Lighting**. Exit signs and means of egress lighting shall conform to the requirements of 780 CMR 1006.0 and 1011.0, as applicable.*

***422.4.1.2 Roof Egress**. Where the roof of a building is used as part of the day care center, required means of egress from the roof shall consist of two enclosed stairways: complying as exits and providing two separate protected ways of travel to exit discharges; or the required means of egress from the roof shall consist of one enclosed stairway complying as an exit providing a protected way of travel to an exit discharge and a protected stairway from the roof leading to a corridor on the floor directly below the roof and such corridor shall lead to two remote and independent exits. Stairways shall comply with the requirements of 780 CMR 10 except as noted in 780 CMR 422.0.*

***422.4.1.2.1 Additional Roof Space Requirements**. Where a roof is used by a day care center, there shall be a solid, smooth non-climbable fence or barrier a minimum of seven feet high on all sides and separating the day care center area for any other uses. Fences shall be set back at least three feet from the outside edge of the exterior wall below. A waterproof telephone or equivalent means of communication shall be located on the roof for use in emergencies and shall be openable without keys, coins, or special knowledge.*

***422.4.1.3 Doors**. All required means of egress doors shall be at least 36 inches in width. All other doors shall be at least 32inches in width.*

***Exception**. Where the occupant load, as calculated in accordance with 780 CMR 1004.0, requires door widths in excess of 36 inches; door widths shall conform to the requirements of 780 CMR 1008.0.*

***422.4.1.4 Handrails**. Handrails shall conform to the requirements of 780 CMR 1009.0 and when the day care center clients include children, in addition to an upper handrail, a lower hand rail shall be installed between 20 inches and 24 inches above the nosing of the stair tread.*

***422.4.1.5 Guards**. Guards shall conform to the requirements of 780 CMR 1012.0.*

***422.4.1.6 Stairways**. Stairways, whether required means of egress interior or exterior stairways or supplemental stairways, shall comply with the requirements of 780 CMR 1009.0 and 780 CMR 34.00 as applicable.*

***Exception**. Existing stairways shall not be required to satisfy the requirements of 780 CMR 1009 unless so required by the Building Official in accordance with 780 CMR 3400.4 or 3400.5.*

***422.4.2 Mixed Use-New and Existing Buildings**.*

***422.4.2.1 Mixed Use- New Construction**. In new construction mixed use buildings, day care centers shall conform to the separation requirements of 780 CMR 302.3.*

***422.4.2.2 Mixed Use- Existing Buildings**. In mixed use existing buildings the day care center walls shall conform to the separation requirements of 780 CMR 302.3 except that the floor - ceiling assemblies of the day care center for the 780 CMR 302.3.2 separation option shall, as a minimum, conform as follows:*

(a) For day care centers located above any usable space - the floor of the day care center shall have a minimum of a one hour fire-resistance rating in buildings of Type V construction; and a minimum of a two hour fireresistance rating in buildings of Type I, II, III and IV construction.

(b) For day care centers located below usable space, the ceiling of the day care center shall have at least a one hour fire-resistance rating or the floor above shall be equipped with smoke detectors interconnected to the day care center fire warning system such that smoke detector activation on the floor above will initiate alarm in the day care center.

***422.4.2.3 Mixed Day Care Use**. When a day care center contains children or adults of mixed ages such that it would be classified in both I-4 and E use groups, the provisions for the most restrictive use shall apply unless the building or portion thereof satisfies the requirements set forth in 780 CMR 302.3.*

***422.4.3 Elevator Doors**. In buildings with elevators, the day care center:*

1. shall not be exposed directly to the elevator doors opening from the elevator shaft, *2. at least one of the required means of egress shall not be exposed to the elevator openings.*

Elevator door openings may be separated by two hour fire rated construction creating elevator lobbies and where such lobbies exist, the requirements of 780 CMR 422.4.3, (1) and (2) are deemed satisfied.

422.4.4 Fire Protective Signaling Systems. *Fire protective signaling systems shall be installed in all day care centers and shall conform to the requirements of 780 CMR 907.0.*

Exception. *Residential occupancies identified in 780 CMR 422.4.5, Exception 1.*

422.4.5 Automatic Fire Detection Systems. *An automatic fire detection system shall be designed and installed in accordance with the requirements of 780 CMR 907.0; 780 CMR 422.4.2.2(b); 780 CMR 422.4.5 and 780 CMR 422.5 as applicable.*

Exception 1. *Residential occupancies that incorporate day care center I-4 or E Use and otherwise comply with all applicable requirements of 780 CMR 422.0, have a day care occupancy not exceeding 24 clients and otherwise do not have, nor are required to have, fire protection systems complying with 780 CMR 903.0 and 780 CMR 907.0 shall be permitted to utilize single and multiple station smoke detectors in accordance with 780 CMR 907.0. In such instances the supervision requirements of 780 CMR 907.0 shall not apply.*

Exception 2. *Single story buildings or portions thereof with day care occupancies not exceeding 24 clients and which otherwise comply with all applicable requirements of 780 CMR 422.0, specifically and 780 CMR generally, shall be required to utilize fire protection systems complying with 780 CMR 9.00, as applicable, but the supervision requirements of 780 CMR 9.00 shall not apply unless the building fire protection systems are otherwise required to conform to such supervision requirements.*

(Note that if the basement or cellar of such a building is used as a portion of the day care center, this exception to 780 CMR 422.4.5 shall not apply).

422.4.5.1 Location of Detectors. *Smoke detectors shall be installed to ensure total coverage of the day care center and also located in front of the doors to the stairways and in the corridor providing required means of egress on all floors of the day care center, and comply with the smoke detector manufacturers listed requirements.*

422.4.5.1.1 Zoning. *Specific smoke detector zoning shall be in accordance with 780 CMR 907.0 with smoke detectors spacing no greater than 30 feet unless otherwise allowed via manufacturer's listing requirements.*

422.4.5.2 Compatibility. *Fire protection signaling systems and/or automatic fire detection systems that are interfaced shall be listed for such mechanical and electrical interfacing.*

CO Detectors. When applicable, carbon monoxide detectors shall be required in all group residences governed by 780 CMR 422.0. In new construction day care centers, and where applicable, CO detectors shall be hard wired and interconnected or otherwise be of an acceptable wireless type and conform to location requirements and listing requirements as set forth in 527 CMR 31.00 or 248 CMR, as applicable.

For existing group residences, CO detectors shall conform to the requirements of 527 CMR 31.00 or 248 CMR, as applicable.

For existing group residences undergoing alteration/renovation, etc., refer to 780 CMR 3404.0 and 3405.0.

422.4.6 Story Height Limitations. *The allowed basement and story locations of day care centers in new and existing buildings shall be limited by the provisions of 780 CMR 422.5, as applicable to the use group classification of the day care center, and Table 780 CMR 422.4.6.*

422.4.6.1 Allowed Height and Area. For new construction day care centers, 780 CMR Table 503 applies.

For existing day care centers, refer to the applicable requirements of 780 CMR 34.00.

Table 422.4.6 PERMITTED LOCATIONS AND REQUIRED SPRINKLER PROTECTION FOR DAY CARE CENTERS

I-4 Child Care Occupancy Children Under Two Years Nine Months of Age

Floor Level of Child Day Care Center	Building Construction Type								
	IA	IB	IIA	IIB	IIIA	IIIB	IV	VA	VB
Basement / Cellar	P	P	P	P	P	P	P	P	P
1st Story	P	P	P	P	P	P	P	P	P
2nd Story	PS	PS	PS	NP	S	NP	S	NP	NP
3rd Story	PS	PS	PS	NP	S	NP	S	NP	NP
4th Story and Higher	NP	NP	NP	NP	NP	NP	NP	NP	NP

E Child Care Occupancy / Children Over Two Years Nine Months of Age

Floor Level of Child Day Care Center	Building Construction Type								
	IA	IB	IIA	IIB	IIIA	IIIB	IV	VA	VB
Basement / Cellar	P	P	P	P	P	P	P	P	P
1st Story	P	P	P	P	P	P	P	P	P
2nd Story	P	P	P	P	P	P	P	P	P
3rd Story	PS	PS	PS	NP	S	NP	S	NP	NP
4th Story	PS	PS	PS	NP	S	NP	S	NP	NP
5th to 7th Story	PS	PS	PS	NP	NP	NP	NP	NP	NP
8th Story and Higher	NP	NP	NP	NP	NP	NP	NP	NP	NP

I-4 - Day Care Occupancy / Adult (Elder) Day Care

I-4-Use day care Facilities are not limited in where they may be located in a building	Exception (1): Adullt day care centers falling under the "Exception" to 780 CMR 424.3.3
	Exception (2): Adult day care centers of mixed-care use as described in 780 CMR 424.4.2.3

Key to Table

P = Permitted

NP = Not Permitted

S = Sprinklers Required / See 780 CMR 422.5 for Special Provisions

PS = Partial Sprinklers Required / See 780 CMR 422.5 for Special Provisions

422.4.7 Heating System. Any portable or permanent heater in spaces occupied by clients shall be separated from the occupied space by partitions, guards, screens, or other means. Space and unit heaters using combustible fuels shall be prohibited. (Also see 780 CMR 422.4.8)

422.4.8 Boiler Rooms. Boilers, furnaces or other fire units shall be enclosed as required in the International Mechanical Code listed in 780 CMR 35.00. Boiler room doors shall not open into occupied areas.

422.4.9 High Hazard Restrictions. A day care center shall not occupy the same building with, or be located within 200 feet of a high hazard occupancy.

422.4.10 Accessibility for Persons with Disabilities. Accessibility requirements shall be in accordance with 521 CMR as listed in 780 CMR 35.00.

422.5 Special Provisions.

422.4.5.1 Application. Special provisions for I-4, E and B use day care centers and relating to allowed location, special egress and special alarm requirements are found in 780 CMR 422.5

422.5.2 I-4 Use Allowed Basement/Cellar/Story Locations. In new and existing buildings, day care centers which are classified in the I-4 use group shall comply with one of the following compliance options listed below. All required means of egress for day care centers classified in use group I-2 shall lead directly to grade.

1. The location of the day care center shall be limited to the first floor, cellar and/or basement; or

2. In buildings of Type IIB, IIIA or IV construction which are fully sprinklered and comply with the special provisions of 780 CMR 422.5.4.4, the day care center shall be located no higher than the third floor; or

3. In buildings of Types IA, IB or IIA construction and are either fully sprinklered, or in which the day care center and all floors below are sprinklered, the day care center shall be located no higher than the third floor.

Notes:

1. Also see 780 CMR Table 422.4.6.

2. See special egress requirements of 780 CMR 422.5.4.

422.5.3 E-Use Allowed Basement/Cellar/Story Locations. In new and existing buildings, day care centers which are classified in the E use group shall comply with one of the following compliance options listed below. All required means of egress for day care centers classified in use group E shall lead directly to grade.

1. The location of the day care center shall be limited to the second floor; first floor or cellar and/or basement, or;

2. In buildings of Type IIB, IIIA or IV construction which are fully sprinklered and comply with the special provisions of 780 CMR 780 CMR 422.5.4.4, the day care center shall be located no higher than the fourth floor; or;

3. In buildings of Types IA, IB or IIA construction which comply with the special provisions of 780 CMR 422.5.4.4 and are either fully sprinklered, or in which the day care center and all floors below are sprinklered, the day care center shall be located no higher than the seventh floor.

Notes:

1. Also see 780 CMR Table 422.4.6.

2. See special egress requirements of 780 CMR 422.5.4.

422.5.4 A-3 Adult Day Care per 780 CMR 308.5.1 Exception Allowed Basement/Cellar/

Story Locations. In day care centers classified in the A-3 adult day care category and where staff and clients in an emergency can exit the building in no more than three minutes, with or without assistance, there is no restriction on locating of the day care center within any basement/cellar or story.

Exceptions:

1. In adult day care centers classified as day care I-4 use see 780 CMR 422.3.3.

2. Adult day care responding to 780 CMR 308.5.1 Exception.

422.5.4 I-2 and E Use Egress Requirements For Basement and Cellar Use.

422.5.4.1 Basement or Cellar Use. A basement or cellar, as defined in 780 CMR 2.00, of a building of Type IIIB or VB construction may be used for a day care center in accordance with the requirements in 780 CMR 422.5.4.1 Items 1. through 3.:

1. There shall be two separate and independent means of egress, remote from each other and leading directly to grade, or;

2. there shall be two separate and independent means of egress, remote from each other and leading to two one hour fire-rated enclosed stairways not more than four feet in height vertically which lead directly to grade and are separated from any other use as an egress by one hour fire-rated partitions and self-closing doors, or;

3. A combination of 780 CMR 422.5.4.1 Items 1. and 2.

422.5.4.2 Fire Protective Systems. Fire protection systems shall comply with the requirements of 780 CMR 422.4.4 and 422.4.5; additionally in basement or cellar use, regardless of building construction type, smoke detectors shall be located in the first story above the basement or cellar location and in any story below grade that may exist below the basement or cellar day care location. Such smoke detectors shall be connected to the day care automatic fire detection system.

422.5.4.3 Common Corridor Exit Access in Buildings of Types I, IIA and IIB Construction. In buildings equipped with a fire suppression system in conformance with 780 CMR 9.0, a common exit access corridor shall be acceptable for providing access to two means of egress required in 780 CMR 422.4.1, such common corridors used for exitway access may be subdivided, to provide separate and independent exitway access by using smoke stop partions complying, as applicable, with the provisions of 780 CMR 710.0 for smoke partitions. Access through interconnected rooms to either side of the smoke stop partition, as provided in 780 CMR 422.4, shall be allowed as a method of complying with 780 CMR 422.5.4.3. If the doors in the smoke stop partitions are normally open, such doors shall be equipped with an automatic hold open device, actuated by either the building fire protective signaling system and/or the building automatic fire detection system to close automatically.

422.5.4.4 I-4 and E use Day Care Centers Located in Upper Stories of a Building. In new and existing buildings containing I-4 day care occupancies where the day care center is located above the first floor, and in new and existing buildings containing E use day care occupancies and where the day care center is located above the third floor, the day care center shall meet also the requirements of 780 CMR 422.5.4.5 through 780 CMR 422.5.4.7.

422.5.4.5 Telephone Communication. The day care center shall have telephones located in every occupied room of the day care center and directly connected to the building fire command center or to a constantly attended station within the building, if such exists, or otherwise such telephones shall utilize standard phone service with such phones having the capability of retaining, and upon manual selection, automatically dialing the emergency number of the fire department having jurisdiction.

422.5.4.6 Alarm Requirements. In addition to the requirements of 780 CMR 422.4.4 and 422.4.5, on the floor of the day care center and/or the floor below, the operation of any water flow device, manual pull station, smoke or heat detector will initiate a special announcement for the day care center to evacuate or proceed to a specific area. The language of the announcement shall be acceptable to the building official and head of the fire department. Smoke detectors shall be installed on the ceiling of the floor below the day care center. Manual pull stations shall be required on the floor located below the care center.

422.5.4.7 Areas of Refuge. In new and existing buildings containing E care occupancies where the day care center is located on the fourth through seventh floors, the day care center shall have direct access to a separate area which shall have a minimum of two hour rated construction separating it from the rest of the building. The area shall adjoin an enclosed stairway with a fire resistance rating of at least two hours. The area shall be sized at nine square feet per person to accommodate the licensed client capacity and staff of the day care center. This provision shall apply to all centers located on the sixth or seventh floors of a building and to *those centers on the fourth or fifth floors whose licensed capacity exceeds 50 clients. (Also see Table 422.4.6.)*

780 CMR 423.0 SUMMER CAMPS FOR CHILDREN

423.1 Definition. Summer camps for children include premises, operated solely between April and October of each year for recreational or other purposes, and having residential facilities. The use of such accommodations for purposes of inspection, certification and inspection fees shall be considered as being similar to a dormitory in Use Group R-2 and subject to the following provisions of 780 CMR 423.0

423.2 New and Existing Occupancies. 780 CMR 423.0 shall apply to existing and new summer camps for children as defined in 780 CMR 423.1.

423.3 Means of Egress. All one-story, one-room buildings having 1,000 square feet or less and having 25 occupants or less shall require only one means of egress provided that:

1. the length of travel does not exceed 50 feet from any point in the building to the outside at grade; and,

2. the minimum width for aisles and corridors shall be three feet.

423.3.1 Emergency Escape. Every sleeping room shall have at least one exterior door or openable window to permit emergency exit or rescue; the windows shall conform to the following restrictions:

1. must be openable from the inside without the use of separate tools;

2. the sill height shall not be more than 36 inches above the finish floor and with a maximum six foot drop from the window sill to grade below the window; and

3. provide a minimum net clear opening area 5.7 square feet. The minimum net clear opening height dimension shall be 24 inches. The minimum net clear opening width dimension shall be 20 inches.

423.4 Fire Protection. Smoke detectors shall be required for existing and new residential units in accordance with 780 CMR 907 .

CO Detectors. When applicable, carbon monoxide detectors shall be required in all summer camps facilities governed by 780 CMR 423.0. In new construction summer camps, and where applicable, CO detector shall be hard wired and interconnected or otherwise be of an acceptable wireless type and conform to location requirements and listing requirements as set forth in 527 CMR 31.00 or 248 CMR, as applicable.

For existing day care centers, CO detectors shall conform to the requirements of 527 CMR 31.00 or 248 CMR, as applicable.

For existing summer camps undergoing alteration/renovation, etc., refer to 780 CMR 34.00.

General Exception for smoke detection and CO detection. Tents and other temporary shelters which are designed to sleep less than eight persons and which have an open side consisting of greater than 1/6 of the perimeter of the shelter or which have built-in provisions for emergency escape.

423.5 Mechanical. If camps are heated, then the building must conform to all applicable code sections and specialized codes, notwithstanding any of the provisions in 780 CMR 423.0.

423.6 Enforcement and Inspections. Enforcement shall be by the local building official who shall inspect and certify the summer camps yearly, prior to season opening. Fees charged shall be in accordance with 780 CMR.

780 CMR 424.0 BULK MERCHANDISING RETAIL BUILDINGS

424.1 General. Bulk Merchandising Retail Buildings have different fire and life safety risks than traditional retail buildings. This difference requires special attention to fire protection and life safety. The purpose of 780 CMR 424.0 is to provide standards to adequately deal with these differences, and to reduce the risk of life loss, injury, and excessive property damage from fire.

424.2 Scope. The provisions of 780 CMR 424.0 shall apply to buildings or structures defined herein as Bulk Merchandising Retail Buildings or portions thereof containing high piled combustible storage as defined in 780 CMR 424.2.1. Unless otherwise noted in 780 CMR 424.0, the requirements for Bulk Merchandising Retail Buildings shall be in accordance with the requirements set forth for Use Group M, Mercantile as defined in 780 CMR 309.0 or 780 CMR 414.0 (if applicable).

424.2.1 Definitions. Terms used in 780 CMR 424.0 shall have the following meanings:

Aerosol. A product that is dispensed from a metal can, up to a maximum size of 33.8 fl oz (1000 ml) or a glass or plastic bottle, up to a maximum size of four fl oz (118 ml) that is designed and intended to dispense an aerosol by a propellant. Aerosols shall be classified by means of the calculation of their chemical heats of combustion and shall be designated Level 1, Level 2, or Level 3 in accordance with Table 424.2.

TABLE 424.2 AEROSOL CLASSIFICATION

Chemical Heat of Combustion	*Aerosol Level*
0-8,600 BTU/lb (0-20 kJ/g)	*1*
8,600-13,000 BTU/lb (20-30 kJ/g)	*2*
13,000 or greater BTU/lb (30 or greater kJ/g)	*3*

Bulk Merchandising Retail Buildings. A building where sales areas contain high piled combustible commodities, or high piled, high *hazard commodities as defined by 780 CMR 4.00 and 780 CMR 3.00.*

Combustible Liquids. Any liquids having a flashpoint at or above 100°F (38°C) shall be known as Class II or III liquids. Combustible liquids shall be divided into the following classification:

Class II - Liquids with a flash point at or above 100°F (37.8°C) and below 140°F (60°C).
Class III-A - Liquids with a flash point at or above 140°F (60°C) and below 200°F (93.3°C).
Class III-B - Liquids with a flash point at or above 200°F (93.3°C).

Control Area. Is a building or portion of a building within which the exempted amounts of hazardous materials are allowed to be stored, dispensed, used, or handled.

Corrosive. A chemical that causes visible destruction of, or irreversible alterations in tissue by chemical action at the site of contact. A chemical is considered to be a corrosive if, when tested on the intact skin of albino rabbits by the method described in Appendix A of CFR 49, Part 173, it destroys or changes irreversibly the structure of the tissue at the site of contact following an exposure period of four hours. This term does not refer to action on inanimate surfaces. (Source: Uniform Fire Code)

Flammable Liquids. Any liquids having a flash point below 100°F (38°C), and having a vapor pressure not exceeding 40 psia (276 kPa) at 100°F (38°C). Flammable liquids shall be known as Class I liquids and shall be divided into the following classification:

I-A Liquid - A liquid with a flash point below 73°F (22.8°C) and a boiling point below 100°F (37.8°C).
I-B Liquid - A liquid with a flash point below73°F (22.8°C) and a boiling point at or above100°F (37.8°C).
I-C Liquid - A liquid with a flash point at or above 73°F (22.8°C) and below 100°F (37.8°C).

Group A Plastics. Products that utilize plastic, or non plastic products that utilize significant plastic packaging materials, that have a high BTU content; ABS (acrylonitrile-butadiene-styrene copolymer), Acetal (polyformaldehyde), Acrylic (polymethyl methacrylate), Butyl rubber, EPDM (ethylene-propylene rubber), FRP (fiberglass reinforced polyester), Natural rubber (expanded), Nitrile rubber (acrylonitrile-butadiene rubber), PET or PETE (polyethylene rephthalate), Polybutadiene, Polycarbonate, Polyester elastomer, Polyethylene, Polypropylene, Polystyrene (expanded and unexpanded), Polyurethane (expanded and unexpanded), PVC (polyvinyl chloride greater than 15% plasticized, e.g., coated fabric unsupported film), SAN (styrene acrylonitrile), SBR (styrene-butadiene rubber).

High Piled Combustible Commodity. Storage of combustible materials in piles greater than 12 feet (3.658 m) in height or combustible materials on pallets, in racks or on shelves where the top of storage is greater than 12 feet (3.658 m) in height.

High Piled, High Hazard Commodity. Storage of combustible materials such as rubber tires, Group A plastics, flammable liquids, idle pallets and commodities with similar heat release characteristics where the top of storage is greater than six feet (1.829 m) in height.

Highly Toxic. Material which produces a lethal dose or lethal concentration which falls within any of the following categories.

1. *A chemical or substance that has a median lethal dose (LD50) of 50 milligrams or less per kilograms of body weight when administered orally to albino rats weighing between 200 and 300 grams each.*
2. *A chemical or substance that has a median lethal dosage of more than 200 milligrams or less per kilogram of body weight when administered by continuous contact for 24 hours, or less if death occurs within 24 hours, with bare skin of albino rabbits weighing between two and three kilograms each.*
3. *A chemical or substance that has a median lethal concentration (LC50) in air of 200 parts per million by volume of gas or vapor, or two milligrams per liter or less of mist, fume or dust, when administered by continuous inhalation for one hour, or less if death occurs within one hour, to albino rats weighing between 200 and 300 grams each.*

Mixtures of these materials with ordinary materials, such as water, might not warrant classification as highly toxic. While this system is basically simple in application, any hazard evaluation which is required for the precise categorization of this type of material shall be performed by experienced, technically competent persons.

Oxidizer. A chemical other than a blasting agent or explosive that initiates or promotes combustion in other materials, thereby causing fire either of itself or through the release of oxygen or other gases.

Class 1. An oxidizer whose primary hazard is a slight increase in the burning rate but which does not cause spontaneous ignition when theoxidizer comes in contact with combustible materials.
Class 2. An oxidizer that will cause a moderate increase in the burning rate or that is capable of causing spontaneous ignition of combustible materials with which the oxidizer

comes in contact.

Class 3. An oxidizer that will cause a severe increase in the burning rate of combustible materials with which the oxidizer comes in contact or that will undergo vigorous self-sustained decomposition due to contamination or exposure to heat.

Class 4. An oxidizer that is capable of an explosive reaction due to contamination or exposure to thermal or physical shock. Additionally, the oxidizer will enhance the burning rate and is capable of causing spontaneous ignition of combustibles. (Source: BOCA)

Rack Storage. Combination of vertical, horizontal and diagonal members that support stored materials in fixed or portable racks.

Shelf Storage. Storage on structures less than 30 in. (76.2 cm) deep with shelves usually two ft (0.6 m) apart vertically and separated by approximately 30 in. (76.2 cm) aisles.

Toxics. A material which produces a lethal dose or lethal concentration within any of the following categories:

1. *A chemical or substance that has a median lethal dose (LD50) of more than 50 milligrams per kilograms but not more than 500 milligrams per kilograms of body weight when administered orally to albino rats weighing between 200 and 300 grams each.*
2. *A chemical or substance that has a median lethal dosage of more than 200 milligrams per kilogram but not more than 1,000 milligrams per kilogram of body weight when administered by continuous contact for 24 hours, or less if death occurs within 24 hours, with bare skin of albino rabbits weighing between two and three kilograms each.*
3. *A chemical or substance that has a median lethal concentration (LC50) in air more than 200 parts per million but not more than 2,000 parts per million by volume of gas or vapor, or more than two milligrams per liter but not more than 20 milligrams per liter of mist, fume or dust, when administered by continuous inhalation for one hour, or less if death occurs within one hour, to albino rats weighing between 200 and 300 grams each.*

Unstable (Reactive). A chemical which in the pure state, or as produced or transported, will vigorously polymerize, decompose, condense or become self-reactive under conditions of shock, pressure or temperature.

Water Reactive Material. Material which explodes; violently reacts; produces flammable, toxic or other hazardous gases; or evolves enough heat to cause self-ignition or ignition of nearby combustibles upon exposure to water or moisture.

424.3 Commodity Classification. Commodities in storage and display shall be classified in accordance with the following NFPA Standards as listed in 780 CMR 35.00.

13: Installation of Sprinkler Systems
30: Flammable and Combustible Liquids Code
30B: Aerosol Products, Manufacture and Storage
231: General Storage
231C: Rack Storage of Materials
231D: Storage of Rubber Tire
430: Storage of Liquid and Solid Oxidizers

424.4 Fire Protection Requirements. Fire protection requirements shall be in accordance with Table 424.4.

TABLE 424.4 FIRE PROTECTION REQUIREMENTS

Commodity Class[1]	*Size of High-Piled Display Area[2] (sq ft) x 0.0929 for m[2]*	*Fire Protection Requirements*				
		Fire Suppression System (780 CMR 426.5)	*Fire Alarm/Notification (780 CMR 426.14)*	*Fire Department Access Doors (780 CMR 426.8)*	*Hose Connections (780 CMR 426.7)*	*Manual Smoke and Heat Vents (780 CMR 426.16*
I-IV	*0 - 2,500*	*NR*	*NR*	*NR*	*NR*	*NR*
	2,501 - 12,000	*Yes*	*NR*	*NR*	*NR*	*NR*
	over 12,000	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
High Hazard	*0 - 500*	*NR*	*NR*	*NR*	*NR*	*NR*
	501 - 2,500	*Yes*	*NR*	*NR*	*NR*	*NR*
	2,501 - 12,000	*Yes*	*NR*	*Yes*	*Yes*	*NR*
	over 12,000	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*

NR = Not required.

1. *For commodity classifications definitions, see 780 CMR 424.3.*
2. *Areas that are separated by 60 ft of display area with such areas not used for high piled storage, or that are separated with a one-hour fireresistance-rated separation barrier, can be considered as separated high piled areas.*
3. *If the building is required to be sprinklered under 780 CMR, then the sprinkler system protecting the high piled storage area and 15 ft beyond shall be designed in accordance with the appropriate NFPA Standard(s).*

424.5 Fire Suppression Systems. Fire sprinkler design and installation shall be provided in accordance with the applicable requirements set forth by NFPA 13, 30, 30B, 231, 231C, 231D, 430, as listed in 780 CMR 35.00, or other nationally recognized codes and standards, or tests conducted in test laboratories as defined in 527 CMR 49.03, Appendix C as listed in 780 CMR 35.00.

424.6 Storage Arrangement. Storage arrangements for fire protection purposes shall comply with requirements set forth by NFPA 13, 30, 30B, 231, 231C, 231D, 430, as listed in Appendix A, or other nationally recognized codes and standards, or tests conducted in test laboratories as defined in 527 CMR 49.03, Appendix C, as listed in 780 CMR 35.00.

424.7 Hose Connections. A Class I automatic, wet-standpipe system shall be provided in accordance with NFPA 14. Hose connections shall be located around the interior perimeter of the building within five ft of all required fire department access doors, adjacent to the latch side of the door. Hose connections shall be installed to accommodate 200 ft of travel distance to any point in the building. Where the most remote portion of the building exceeds 200 ft of travel distance from the required access doors, additional hose connections shall be provided in locations approved by the head of the fire department. Hose connections shall be readily accessible and marked for fire department use only. When approved by the head of the fire department, the following exceptions shall be permitted.

Exception 1. Hose connections may be omitted when the following fire department building access and fire hydrant coverage is provided: minimum 18 ft wide, unobstructed access roadways located within 20 ft of the building on at least three sides; minimum ten ft wide, unobstructed access route between the access roadway and the fire department access doors; and, fire hydrants in locations approved by the head of the fire department.

Exception 2. In lieu of a Class I stand pipesystem, a Class II automatic, wet-standpipe system in accordance with NFPA 14 shall be permitted when the following fire department building access and fire hydrant coverage is provided: minimum 18 ft wide, unobstructed access roadways located within 50 ft of the building on at least three sides; minimum ten ft wide, unobstructed access route between the access roadway and the fire department access doors; and, fire hydrants in locations approved by the head of the fire department. The hose connections shall be located as described above for the Class I standpipe system. Occupant hose shall not be required, and the hose connections shall be marked for fire department use only.

424.8 Fire Department Access Door. Fire department access doors shall be provided for fire department emergency access. Access doors shall be:

1. *located adjacent to fire department access roadways,*
2. *provided with an approved exterior fire department accessible key cylinder operable lock device,*
3. *provided with approved fire department identification signs, and*
4. *provided such that all points of the floor area are accessible within 200 feet of travel distance.*

Fire department access doors may be used as occupant egress doors.

424.9 Fire Department Access Roadways. Fire department access roadways shall be provided on at least two sides of the building with such access to be approved by the head of the fire department prior to any construction. Fire hydrants shall be provided in locations approved by the head of the fire department.

424.10 Means of Egress. Means of egress shall be in accordance with the requirements set forth in 780 CMR 10.00 for Use Group M, Mercantile unless otherwise modified in 780 CMR 424.10.

Exception. Exit access travel distance shall be limited to 200 feet.

If the only means of customer entrance is through one exterior wall of the building, two thirds of the required egress width shall be located in this wall. At least one half of the required exits shall be located so as to be reached without passing through checkout stands. In no case shall checkout stands or associated railings or barriers obstruct exits, required aisles, or approaches thereto.

424.11 Flammable/Combustible Liquids. The display, storage, protection, and maximum allowable quantities of flammable and combustible liquids permitted in mercantile display areas shall be in accordance with NFPA 30, as listed in 780 CMR 35.00.

424.12 Aerosols. The display, storage, protection, and maximum allowable quantities of aerosols permitted in mercantile occupancies shall be in accordance with of NFPA 30B.

TABLE 424.13 DENSITY FACTOR FOR HAZARDOUS MATERIALS EXEMPTION CALCULATIONS.

Material	Class	Solids pounds[1] (cubic feet)	Liquid gallons[1] (pounds)	Gas cubic feet[1]
		x 0.4536 for kg (x 28.32 for liters)	x 3.78 for liters (x 0.4536 for kg)	x 28.32 for liters
Oxidizers	4	Not permitted	Not Permitted	Not Permitted
	3	0.75	(0.75)	112.5
	2	1.5	(1.5)	9
	1	12	(12)	4.5
Unstable (reactive)	4	Not Permitted	Not Permitted	Not Permitted
	3	0.375	(0.375)	3.75
	2	0.3	(0.3)	1.5
	1	Unlimited	Unlimited	2.25
Toxics	All	0.65	(0.65)	1.053
Corrosives	All	6.5	0.65	1.053
Highly Toxic	All	0.0013	(0.0013)	0.026
Water Reactive	3	0.375	(0.0375)	Not Applicable
	2	0.3	(0.3)	
	1	0.375	(0.375)	

1. Quantities may be increased by 100% in sprinklered buildings

424.13 Non-flammable and Non-combustible Hazardous Materials. Non-flammable and non-combustible hazardous materials such as: Oxidizers, Unstable Materials, Toxics, Highly Toxics, Corrosives, and Water Reactives shall meet the following requirements:

$$Q = F \times A$$

where:

Q = the maximum quantity in a single control area for mercantile display.

F = the density factor as indicated in Table 424.13.

A = the area occupied for mercantile display. For computation purposes, the area shall not exceed 1,500 square feet (139.39 m^2) per control area.

424.14 Fire Alarm or Notification Systems. Either a fire alarm system or emergency notification system, as described below and approved by the head of the fire department, shall be provided:

1. Fire Alarm System. The fire alarm system shall include the following:

a. A fire alarm system required for life safety shall be installed, tested, and maintained in accordance with applicable requirements of 527 CMR 12.00 and NFPA 72, as listed in 780 CMR 35.00.

b. All systems and components shall be approved for the purpose for which installed, and all installation wiring or other transmission paths shall be monitored for integrity in accordance with NFPA 72, as listed in 780 CMR 35.00.

c. Manual fire alarm stations shall be provided in the natural path of escape near each required exit from an area. Each manual fire alarm station shall be accessible, unobstructed, visible, and of the same general type.

d. Notification signals for occupants to evacuate shall be by audible and visible signals in accordance with NFPA 72 and 527 CMR, as listed in 780 CMR 35.00. The general evacuation alarm signal shall operate throughout the entire building.

e. The fire alarm system shall be arranged to transmit the alarm automatically via any of the following means acceptable to head of the fire department and in accordance with NFPA 72:

- *i. Auxiliary Alarm System*
- *ii. Central Station Connection*
- *iii. Proprietary System, or*
- *iv. Remote Station Connection.*

f. The fire alarm control panel location shall be located in an area acceptable to the head of the fire department. Where required, a remote annunciator shall be located in an area acceptable to the head of the fire department.

g. Other control systems intended to make the protected premises safer for building occupants including, but not limited to, duct smoke detectors, fire/smoke dampers, smoke management systems, fire door controls, shall be installed and monitored for integrity in accordance with NFPA 72, as listed in 780 CMR 35.00, and a distinctive supervisory signal shall be provided to indicate a condition that would impair the satisfactory operation of the equipment.

h. Supervisory attachments including, but not limited to, control valves, fire pump running conditions, float valves, shall be installed and monitored for integrity in accordance with NFPA 72 as listed in 780 CMR 35.00, and a distinctive supervisory signal shall be provided to indicate a condition that would impair the satisfactory operation of the equipment.

i. All building HVAC fans shall be arranged to automatically shut down on any general alarm condition. Duct smoke detectors shall not be required.

j. Waterflow initiating devices shall be arranged to initiate an alarm condition within one minute of being activated. In addition, provisions shall be made to control and prevent false alarms due to water surges.

2. Emergency Notification System. During a fire emergency, the emergency notification system shall sound an audible alarm in a continuously attended location for the purpose of initiating the evacuation plan required under 780 CMR 424.15.

424.15 Evacuation Planning and Training. An evacuation plan shall be submitted at the time of application for a building permit as part of the required documentation pursuant to 780 CMR 1.00. The Certificate of Use and Occupancy shall not be issued until the evacuation plan has been reviewed and approved by the head of the fire department. Any changes to the evacuation plan shall not be effected until a revised plan has been submitted to and approved by the head of the fire department. The evacuation plan shall detail procedures, define roles and responsibilities of employees, and shall include an egress plan indicating routes of travel to all exits. The evacuation plan shall be used to ensure the safe evacuation of all customers and employees. All employees shall be instructed and periodically trained with respect to their duties, as required by 527 CMR 10.25, as listed in 780 CMR 35.00.

424.16 Smoke and Heat Venting. Adequate methods of manual heat and smoke venting shall be provided. The method of operation, vent area, spacing layout, construction of vents and curtain boards or other acceptable means of addressing methods of heat and smoke venting shall be determined by an engineering evaluation and analysis. The analysis shall be reviewed and approved by the head of the fire department and shall contain sufficient detail to evaluate the hazard and effectiveness of the venting system.

780 CMR 425.0 LIMITED GROUP RESIDENCE

425.1 General. A building licensed by or operated by the Department of Mental Health or the Office for Children, Commonwealth of Massachusetts as a limited group residence: this is a special residence to include residents not capable self-preservation.

425.1.1 Scope. A limited group residence shall have a maximum of 12 residents who are at least four years of age. Not more than four of the residents shall be impaired; provided, however, that more than four such residents may be impaired if the structure complies with 780 CMR 425.2. A limited group residence shall be classified in the R-5 use category for code purposes.

425.1.1.1 Department of Mental Retardation (DMR) Group Homes. 780 CMR 427.0 shall not apply to premises operated or licensed by the Department of Mental Retardation (DMR) pursuant to 115 CMR 7.00 and 8.00, upon the completion of a DMR safety assessment for each individual and an approved safety plan for each location where services and supports are provided. Such premises shall be treated as conventional R-4, R-3, R-2 and R-1 use as applicable.

425.1.2 Definitions. The following terms shall have the meaning indicated for the purpose of 780 CMR 425.0:

Existing Building or Structure. Any completed building or structure which has been legally occupied and/or legally used for a period of at least five years. Structures which fail to qualify with this definition shall comply with 780 CMR 425.2

Resident. A client in need of care who resides in the limited group residence of the licensing or operation agency. Staff are not considered as residents under the provisions of 780 CMR 425.0. The licensing agency shall classify all residents in one of the following three categories:

Impaired. All residents not capable of self-preservation through physical, mental and/or developmental disability and requiring physical assistance to exit the building. All residents under seven years of age shall be classified as impaired.

Partially Impaired. All residents physically, mentally and/or developmentally disabled but capable of exiting the limited group residence with either supervision and/or instruction without any physical assistance.

Unimpaired. All residents capable of exiting the building without physical assistance and/or supervision or instruction by staff personnel and capable of negotiating any exitway of the limited group residence.

425.1.3 Application of Building Code and Reference. Except as may otherwise be specifically provided for in 780 CMR 425.0, the Massachusetts State Building Code shall apply in its entirety.

Exception. 780 CMR 34.00 shall not apply.

425.1.4 Mixed Use Occupancy. A limited group residence shall not be housed in a building used for any occupancy other than a limited group residence.

Exception. Dwelling unit(s) meeting the requirements of 780 CMR 425.0 may be incorporated within a building in residential use provided unit separation walls and floor-

ceiling assemblies shall serve to completely separate the limited group residence and provided that one of the limited group residence exitways is separate from the other uses.

425.1.5 Plans and Specifications. Plans shall be filed with the building official having jurisdiction in accordance with 780 CMR 110.0 for any building to be constructed as, or altered for use as, a limited group residence under 780 CMR 425.0.

425.1.6 Temporary Certificate of Occupancy. Upon satisfactory compliance with the code sections pertaining to building requirements, the building official shall issue a temporary certificate of occupancy in accordance with 780 CMR 120.3 for a period not to exceed 90 days. This temporary certificate of occupancy specifically prohibits residents as defined in 780 CMR 425.1.2 from inhabiting the building overnight until the building official issues the certificate of occupancy under 780 CMR 425.1.8.

425.1.7 Rules and regulations of the licensing or operating agency pertaining to and including, but not limited to, smoking regulations, staffing ratios, and resident classifications shall be provided to the building official by the licensing or operating agency prior to the issuance of a certificate of occupancy.

425.1.8 Certificate of Occupancy. Certificates of occupancy shall only be issued when a license, if appropriate, and an affidavit from the Department of Mental Health or the Office for Children, Commonwealth of Massachusetts, have been accepted by the building official attesting to the satisfactory compliance with the applicable rules and regulations referenced in 780 CMR 425.1.7.

425.1.9 Certificate of Inspection. Certificates of inspection shall be issued by the building official in accordance with 780 CMR 106.0 and Table 106.

425.1.10 Failure to Comply. The building official immediately upon being informed by written report or otherwise that a building or structure or anything attached thereto or connected therewith is being occupied in violation of 780 CMR may revoke or suspend any permit, license, certificate or other permission regulated by 780 CMR and granted by him, and no such building or structure shall be continued to be operated after such revocation or suspension. Such revocation or suspension shall not preclude the building official from instituting appropriate action in accordance with 780 CMR 118.0.

425.2 New Structures. All new structures shall be constructed, equipped, and maintained to the requirements of the One- and Two-Family Dwelling Code and 780 CMR 425.0, shall be limited to two stories in height, and shall have dwelling unit(s) limited to one story in height with direct access to grade without steps or changes in elevation other than ramps in accordance with 521 CMR or otherwise per applicable requirements of 780 CMR 10.00 for ramps. Corridors shall be of one hour fireresistive construction.

425.2.1 Other requirements. New structures shall also satisfy the general requirements contained in 780 CMR 425.1 and 425.3.

425.3 Existing Structures. Existing structures of any construction up to three stories or 40 feet in height may be converted and used for limited group residence occupancies. All residents classified as impaired as defined in 780 CMR 425.1.2 are restricted to those stories having direct access to grade without steps or changes in elevation other than ramps in accordance with 521 CMR or otherwise per applicable requirements of 780 CMR 10.00 for ramps.

425.3.1 Third-story Utilization. The third story of buildings permitted by 780 CMR 425.3 may be only occupied by staff. Other use of the third story is restricted to heating, ventilation units and ordinary storage. All doors leading to nonresident areas shall be maintained locked.

425.3.2 Vertical Openings. Openings to such spaces as laundry chutes, dumb-waiters, heating plenums or combustible concealed spaces shall be permanently blocked with one hour construction, in accordance with the provisions of 780 CMR 7.00, unless such installation is in compliance with the pertinent provisions of other sections of 780 CMR.

425.3.2.1 Firestopping and Draftstopping. Firestopping and draftstopping shall be provided in accordance with 780 CMR 717.0 and the One- and Two-Family Dwelling Code or as approved by the building official.

425.3.3 Exitway Details.

425.3.3.1 Corridor Width. The minimum clear width of an exitway access corridor shall be three feet.

Exception. In new structures the minimum clear width shall be four feet.

425.3.3.2 Dead Ends. In no case shall dead end corridors exceed 30 feet. Existing dead end corridors, wherever possible, shall be altered so that exitways shall be accessible in at least two different directions from all points in corridors.

425.3.3.3 Corridor Walls. Corridor walls that separate use areas from exitway access corridors shall be of construction that will resist the passage of smoke.

Exception. Existing openings to congregate living areas, other than kitchens, shall be allowed to remain open.

425.3.3.4 Sleeping Room Doors. All sleeping room doors shall be of construction that will resist the passage of smoke. All doors shall be equipped with approved positive latching hardware and approved self-closing devices.

Exceptions:

1. Sleeping room doors may be equipped with approved hold-open smoke activated Devices.

2. Hollow core doors shall not be permitted.

425.3.3.5 Means of Egress. All habitable floors shall be provided with at least two means of egress, located as remote as practicable from one another. Exitways shall be located to provide a safe path of travel to a public way without traversing any corridor or space exposed to an unprotected open stairway.

Exceptions:

1. Open stairs may be used as one of the required means of egress when permitted by 780 CMR 425.3.3.6, Exception 3. However, in no case may both required means of egress traverse the unprotected open space.

2. Access to one of the required exitways on sleeping room floors may be through adjoining rooms.

425.3.3.6 Interior Exitway Stairs. Every story shall be provide with at least one enclosed interior stairway which discharge directly to grade or through a grade passageway to a public way. The enclosed interior stairway(s) shall be of construction having a minimum fireresistance rating of one hour, properly firestopped. Spaces below the stairway(s) shall be enclosed to maintain the integrity of the one hour fireresistive construction of the stairway enclosure. Stairway(s) openings shall be protected by at least Class "B" label one hour fire door assemblies. New stair construction shall comply with 780 CMR 1009.0. Existing stairs shall comply with 780 CMR 51.00 through 99.00 (the One- and Two-Family Dwelling Code) or as approved by the building official.

Exceptions:

1. Secondary stairs not considered an exitway component may have door openings protected by a minimum $1^{3/8}$ inch solid bonded wood core doors or equivalent; however, such doors shall be equipped with approved automatic positive latching hardware and approved self-closing devices.

2. Basement/cellar. Stairway(s) shall be separated from the first floor by a 20 minute fire rated, self-closing door or it equivalent.

3. One stairway may be allowed to remain unenclosed to preserve functional and aesthetic requirements.

425.3.3.7 Door Widths. No single egress door in a doorway shall be less than 28 inches wide.

Exceptions:

1. Exitway door leaves shall not be less than 34 inches wide.

2. Door leaves to resident bedrooms occupied by residents who are classified as "Impaired" shall not be less than 34 inches wide.

425.3.3.8 Basement/Cellar. Basements/cellars shall be provided with at least two acceptable exitways, one of which shall discharge directly to the outside of the building.

Exception. Basement/Cellar areas with only one existing entrance from the outside only, and used solely as a mechanical space shall be permitted to maintain only one doorway which shall be maintained locked as an entrance/exitway.

425.3.3.9 Emergency Escape. All sleeping rooms shall have at least one openable window or exterior door to permit smoke control, emergency escape, or rescue. A required door or window must be openable from the inside without the use of separate tools, and shall comply with applicable requirements of 780 CMR 1025.

425.3.3.10 Means of Egress Lighting. Means of egress lighting systems shall be provided in accordance with 780 CMR 1006.

425.3.3.11 Locks. Locks installed in resident sleeping room doors shall be so arranged that they can be locked from the corridor side. All such locks shall be arranged to permit exit from the room by a simple operation without the use of a key. Double cylinder dead bolts requiring key operation on both sides are prohibited throughout this occupancy.

425.3.4 Interior Finish. The flame spread of interior finish shall be limited to Class II in exitways or exit access corridors. Rooms shall be permitted to have interior finish of a Class III flame spread. Floor coverings shall conform to the requirements of 780 CMR 804.0 except that carpet type floor coverings shall possess a critical radiant flux of 0.22 w/cm or greater.

425.3.5 Fire Suppression Systems. Automatic fire suppression systems shall be provided and installed in accordance with NFPA Standard No. 13D for one- and two-family-style buildings and otherwise see 780 CMR 9.00 for suppression requirements.

Additions:

1. Exceptions listed in NFPA Standard No.13D applicable to dwellings shall not apply.

2. A water flow detector, connected to the fire alarm system, shall be provided.

3. NFPA Standard No. 13D, Sections 4 through 6; Exception 1. shall not apply.

4. The control valve(s) shall be secured in the open position.

425.3.6 Fire Alarm System. A manual fire alarm system shall be provided and installed in accordance with 780 CMR 907.0 and specifically NFPA Standard No. 72 as listed in 780 CMR 35.00.

425.3.7 Automatic Protection Alarm System. Approved smoke detectors shall be installed in accordance with 780 CMR 907.0 and specifically NFPA Standard No. 72 as listed in 780 CMR 35.00 in the following locations:

1. exitway access corridors not more than 30 feet on center;

2. congregate living areas other than kitchens;

3. at least one detector in all basement/cellar areas; and

4. all sleeping rooms.

Exception. Smoke detectors used in comination with automatic closing devices may be substituted in each area mentioned in 780 MR 425.3.7 for the protection required.

425.3.8 Fire Department Connection. All automatic and manual fire alarm systems shall be electrically interconnected; this combined system shall automatically transmit an alarm to the municipal fire department or to such other outside assistance as may be available. Such connection shall be made in accordance with NFPA Standard No. 72 as listed in 780 CMR 35.00.

425.3.9 Heating Devices. Portable comfort heating devices and solid fuel burning appliances are prohibited. Any heating device, other than a central heating plant, shall be so designed and installed that combustible material will not be ignited by it or its appurtenances. If fuel-fired, such heating devices shall be chimney or vent connected, shall take air for combustion directly from the outside, and shall be so designed and installed to provide for complete separation at the combustion system from the atmosphere of the occupied area. The heating system shall have safety devices to immediately stop the flow of fuel and shut down the equipment in case of either excessive temperature or ignition failure.

Exceptions:

1. Approved suspended unit heaters may be used in locations other than means of egress and sleeping areas, provided such heaters are located high enough to be out of the reach of persons using the area and provided they are equipped with the safety devices specified in 780 CMR 425.3.9.

2. Fireplaces which comply with 780 CMR 21.00 (ACI 530) may be used only in areas other than resident sleeping rooms. The fireplaces shall be equipped with a heat tempered glass fireplace enclosure guaranteed against breakage up to a temperature of 650°F. A lock on the enclosure shall be required.

425.3.10 Fire Drills. The licensing or operating agency shall require that fire drills be held with sufficient frequency so as to familiarize all residents and staff personnel with emergency procedures. Drills shall be held at unexpected times under varying conditions to simulate the unpredictable conditions which may occur in case of fire, including blocking of any point of any means or egress.

425.3.10.1 Log. A log shall be kept of all fire drills and shall be available for inspection and duplication by the building official, fire official, and other parties having jurisdiction.

425.3.10.2 The resident manager shall record in said log the names of any authorized inspectors who may have been present and the names or identifying numbers of the residents who participated.

780 CMR 426.0 DETOXIFICATION FACILITIES

426.1 General. A detoxification facility is a facility licensed or operated by the Department of Public Health, Division of Alcoholism in accordance with the Rules and Regulations for Detoxification Facilities issued by the Department of Public Health, Division of Alcoholism, Commonwealth of Massachusetts, and shall be used to treat individuals acceptable to the program in accordance with those Rules and Regulations.

426.2 Scope. Detoxification facilities shall be subject to the requirements of 780 CMR 426.0 for new and existing buildings which are to be used or operated as licensed facilities. 780 CMR 426.0 shall establish the requirements applicable to such facilities. Where specific reference is made to other sections of 780 CMR, to reference standards or other regulations, those requirements cited shall apply. Where no reference is specifically made, 780 CMR, including 780 CMR 34.00, as applicable, shall apply.

426.3 Classification of Residents. All residents enrolled in the detoxification program shall be identified according to one of the following classifications when evaluated by the facility personnel in accordance with the Rules and Regulations for Detoxification Facilities of the Division of Alcoholism of the Department of Public Health:

1. Impaired

2. Partially Impaired

3. Unimpaired

426.4 Definitions. The following terms shall have the meaning indicated for the purpose of 780 CMR 426.0 only.

Impaired. Anyone who will require assistance to egress the building.

Partially Impaired. Anyone who may require assistance to egress the building.

Unimpaired. Anyone who appears able to egress the building without assistance.

426.5 Use Group Classification. Detoxification facilities licensed and approved in accordance with these provisions shall be classified in the R-1 use group.

426.6 Mixed Use Occupancy. A portion of a building may be used for a detoxification facility provided that it is completely separated from the rest of the building by both horizontal and vertical fire division assemblies of at least one hour fireresistance rating.

Exception. Detoxification facilities shall not be located in buildings in which any of the following use groups are located: A-2, F, H, or S-1.

426.7 Submission of Plans. Plans shall be filed with the building official in accordance with 780 CMR 110.0 for any building to be constructed as, or altered for use as, a detoxification facility under 780 CMR 426.0. The plans shall also identify those rooms which comply with 780 CMR 426.0 for use by the impaired.

426.8 Inspection and Certification. The building official shall inspect and certify detoxification facilities once every two years.

426.9 Resident Location Limitations. In buildings used as detoxification facilities in accordance with 780 CMR 426.0, resident locations shall be limited according to the use and type of construction as provided in Table 426.9. All heights are in stories above grade. All buildings used as detoxification facilities in accordance with 780 CMR 426.0 shall be accessible to the Fire Department wherever escape windows are required.

TABLE 426.9 RESIDENT SLEEPING ROOM LOCATION LIMITATION FOR DIFFERENT TYPES OF CONSTRUCTION

Classification of Resident	*Type of Building Construction*								
	IA	*IB*	*IIA*	*IIB*	*IIIA*	*IIIB*	*IV*	*VA*	*VB*
Impaired	*No limit*	*8 st.*	*4 st.*	*1 st.*	*2 st.*	*1 st.*	*2 st.*	*1 st.*	*1 st.*
Partially impaired	*No limit*	*No limit*	*8 st.*	*1 st.*	*3 st.*	*2 st.*	*3 st.*	*2 st.*	*1 st.*
Unimpaired	*No limit*	*No limit*	*9 st.*	*3 st.*	*4 st.*	*3 st.*	*4 st.*	*3 st.*	*2 st.*

*Note: * Impaired sleeping rooms in VB construction require either full building sprinklering or one hour fire rated separation for floor and ceiling of sleeping room walls.*

426.9.1 Sprinklered Buildings. Buildings which are completely sprinklered may have resident locations one story higher than allowed in Table 426.9.

426.9.2 Sleeping Room Limitations. Sleeping facilities in building licensed for use as detoxification facilities shall not be located below the first story.

426.10 Egress. At least two exitways located as remote as practicable from each other shall be provided from each floor of the building.

426.10.1 Every room used for sleeping for the impaired and partially impaired shall have an exitway access door leading directly to an exitway access corridor.

Exceptions:

1. Rooms having a means of egress doorway leading directly to the exterior of the building at grade.

2. Rooms having a means of egress doorway leading directly to the exterior of the building above grade and connected directly to grade by means of an exterior stairway in accordance with 780 CMR 1009.0.

426.10.2 All Other Sleeping Rooms. All other sleeping rooms shall comply with the requirements of 780 CMR 10.00 in accordance with the provisions for the R-1 use group.

426.10.3 Corridors shall provide at least 36 inches minimum nominal width.

426.10.4 All means of egress doorways shall be 32 inches minimum nominal width.

Exception. Egress doorways from impaired sleeping rooms shall be 36 inches minimum nominal width.

426.10.5 Every required exitway access corridor shall have a one hour fire-resistance rating and shall provide access to at least two approve exitways without passing through any intervening rooms or spaces other than corridors and lobbies.

Exception. In buildings with a complete sprinkler system, exitway access corridors not required for the impaired or partially impaired may be separated from other use areas by non-fire rated partitions.

426.10.6 Stairways. Where not otherwise specified in 780 CMR 426.0, stairway required as a means of egress shall be subject to these requirements.

426.10.6.1 Stairways required to provide egress for the impaired shall be at least 36 inches minimum nominal width. The total capacity of the stairways shall be adequate for the occupancy load served.

426.10.6.2 Stairway enclosures shall have a fireresistance rating of one hour for buildings not exceeding three stories in height, and two hours for buildings exceeding three stories in height.

426.10.6.3 Doors to the required exitway stairways shall be fire doors complying with 780 CMR 715.0 . Labeled fire doors shall have a maximum transmitted temperature end point of not more than 450 °F (232 °C) above ambient at the end of 30 minutes of standard fire test exposure.

426.11 Interior Finish. Interior finish requirements shall comply with Table 426.11.

Exceptions.

1. In buildings which are completely sprinklered, the interior finish requirements may be reduced one level except in sleeping rooms for the impaired.

2. The interior finish classifications in existing buildings may be improved one level by the use of fire retardant coatings which have been approved when tested in accordance with ASTM E-84.

TABLE 426.11 INTERIOR FINISH REQUIREMENTS

Location	Walls	Floor	Ceiling
Sleeping rooms, Impaired	II	II[2]	II
Corridors, Impaired	I	I[1]	I
Sleeping rooms, Partially impaired	I	I[1]	I
Corridors, Partially impaired	I	I[1]	I
All other exitway access corridors	II	II[2]	II
Stairways	I	I[1]	I

Note 1: Carpet type floor coverings shall withstand a test exposure of 0.45 watts per square centimeter when tested in accordance with 780 CMR 804.0.

Note 2: Carpet type floor coverings shall withstand a test exposure of 0.22 watts per square centimeter when tested in accordance with 780 CMR 804.0.

426.12 Fire Alarm Systems. Manual and automatic fire alarm systems shall be provided in accordance with 780 CMR 907.0 as they apply to Use Group R-1.

Exceptions:

1. In rooms for the impaired and partially impaired approved smoke detectors shall be utilized and where required, visible alarm notification appliances shall also be incorporated.

2. Buildings or portions thereof with 25 beds or less shall have as a minimum a Type II system as described in 780 CMR 918.0: buildings with 26 beds or more shall have as a minimum a Type I system as described in 780 CMR 918.0.

3. All buildings or portions thereof regardless of the number of beds shall incorporate manual pull stations in conformance with 780 CMR 907.0

426.12.1 All automatic and manual fire alarm systems shall be electrically interconnected; this combined system shall automatically transmit an alarm to the municipal fire department or to another approved source of assistance. Such communication shall be made in accordance with NFPA Standards No. 72 as listed in 780 CMR 35.00.

426.13 Means of Egress Lighting. Means of egress lighting including an emergency lighting system shall be provided throughout the facility in accordance with 780 CMR 10.

426.14 Smoke Enclosure Doors. Smoke enclosure doors shall be tight-fitting with approved hardware.

426.15 Heating Apparatus. The use of portable heaters, solid fuel burning room heaters and fireplaces shall be prohibited.

426.16 Sprinkler Systems. Where a complete building sprinkler system is installed it shall comply with the provisions of NFPA Standard No. 13, as listed in 780 CMR 35.00.

426.16.1 All rooms used for sleeping for the impaired shall be sprinklered.

Exception. A partial system required for sleeping rooms housing impaired individuals may be provided with a sprinkler system serving no more than six sprinklers, which may be connected directly to a domestic water supply system having capacity sufficient to provide 0.15 gallons per minute per square foot of floor area throughout the entire area. An indicating shut-off valve shall be installed in an accessible location between the sprinklers and the connection the domestic water supply.

780 CMR 427.0 GROUP DWELLING UNITS

427.1 General. A Group Dwelling Unit is a dwelling unit licensed by or operated by the Department of Mental Retardation or the Department of Mental Health as special residence for up to four persons who may or may not be capable of self preservation from fire or other related hazards. Note, however, 780 CMR 427.1, Exceptions 1. and 2. The provisions of 780 CMR 427.0 shall apply to both new and existing Group Dwelling Units.

Exceptions:

1. 780 CMR 427.0 shall not apply to a group dwelling unit operated or licensed by the Department of Mental Retardation (DMR) pursuant to 115 CMR 7.00 and 8.00, upon the completion of a DMR safety assessment for each individual and an approved safety plan for each location where services and supports are provided. Such premise shall be treated as conventional R-4, R-3, R-2 and R-1 use as

applicable.

2. Apartment programs as defined in 104 CMR 17.13(2)(c) in which residents therein are also capable of self preservation (unimpaired) shall be exempt from all requirements of 780 CMR 427.0. Such apartment programs shall be classified as R-1, R-2, R-3, or R-4, as applicable.

427.1.1 Classification of Use. Group Dwelling Units shall be classified as follows:

> *Use Group R-1 - The Group Dwelling Unit has three or more dwelling or sleeping units and where the occupants (not including staff) are transient in nature and occupancy is for no more than 30 days.*
>
> *Use Group R-2 - The Group Dwelling Unit(s) is (are) one or more of three or more dwelling units contained in the building.*
>
> *Use Group R-3 or R-4 - The Group Dwelling Unit(s) is (are) contained in a one or two family dwelling.*

427.1.2 Classification of Residents. Persons other than staff of the facility who occupy or intend to occupy Group Dwelling Units shall be classified by the Licensing or Operating Agency in one of the following three categories according to their capabilities for self preservation:

> *Impaired. Any resident who is incapable of self preservation through physical, mental or developmental disability, so as to require physical assistance from the staff of the Group Dwelling Unit to exit the building or to reach an area of refuge within 2½ minutes.*
>
> *Partially Impaired. Any resident who is capable with either supervision or instruction from the staff of the Group Dwelling Unit but without physical assistance, of exiting the building or reaching an area of refuge within 2½ minutes.*
>
> *Unimpaired. Any resident who is capable of exiting the building or reaching an area of refuge within 2½ minutes without physical assistance, supervision or instruction.*

427.1.3 Application of 780CMR and Reference. Except as may otherwise be specifically provided in 780 CMR 427.0, 780 CMR shall apply in its entirety.

> *Exception. 780 CMR 34.00 shall not apply. However, existing buildings may be used to house group dwelling units, provided that they comply with the applicable portions of 780 CMR 427.0, and have no outstanding violations of 780 CMR or the specialized codes.*

427.1.4 Plans and Specifications. Plans shall be filed with the building official having jurisdiction in accordance with 780 CMR 110.0 for any building to be constructed as, or altered for use as a Group Dwelling Unit under 780 CMR 427.0.

427.1.5 Temporary Certificate of Occupancy. Upon satisfactory compliance with the code sections pertaining to building requirements, the building official shall issue a temporary certificate of occupancy in accordance with 780 CMR 120.3 for a period not to exceed 90 days. This temporary certificate of occupancy specifically prohibits residents as defined in 780 CMR 427.1.2 from inhabiting the building overnight until the building official issues the certificate of occupancy under 780 CMR 427.1.8.

427.1.6 Corresponding Rules and Regulations. 115 CMR (the Department of Mental Retardation) or 104 CMR 17.13 (the Department of Mental Health) as listed in 780 CMR 35.00 to and including, but not limited to, smoking regulations, staffing ratios, and resident classifications shall be provided upon request to the building official by the Licensing or Operating Agency prior to the issuance of a certificate of occupancy. Note, however, 780 CMR 427.1, Exceptions 1. and 2.

427.1.7 Certification of Residents. The Licensing Agency shall certify the classification of each resident prior to application for a Certificate of Occupancy and shall regularly re-examine and, where necessary, reclassify residents in accordance with Department of Mental Retardation or Department of Mental Health regulations as listed in 780 CMR 35.00 the current certification of each resident shall be kept on file at the Group Dwelling Unit, and shall be made available to the building official upon request. Note, however, 780 CMR 427.1, Exceptions 1. and 2.

427.1.8 Certificate of Occupancy. Certificates of occupancy shall be issued only when a license and/or affidavit from the Department of Mental Retardation or the Department of Mental Health have been provided to the building official attesting to the satisfactory compliance with the applicable rules and regulations referenced in 780 CMR 427.1.6, the capabilities for self preservation of all residents, and, if appropriate, the intent to license the facility. Upon compliance with all building requirements of 780 CMR 427.0 and receipt of the Licensing Agency's affidavit, the building official shall issue a certificate of occupancy within 72 hours. In addition to the contents specified in 780 CMR 120.4, the certificate shall indicate the category of Group Dwelling Unit for which the building has been constructed or altered, as defined in 780 CMR 427.2. Note, however, 780 CMR 427.1, Exceptions 1. and 2.

427.2 Category of Unit/Compliance Options. New and existing building containing Group Dwelling Units shall be required to satisfy at least one compliance option presented for the appropriate *category of residency as defined in 780 CMR 427.2:*

Category A Group Dwelling Unit - May contain any or all of the resident classifications.
Category B Group Dwelling Unit - May contain only partially impaired or unimpaired residents.

Category C Group Dwelling Unit - Shall contain only unimpaired residents.

427.2.1 Category A Unit Compliance Options. Buildings housing Group Dwelling Units classed as "Category A" shall comply with any one of the following compliance options:

1. *The entire building shall be equipped with a fire suppression system; or*
2. *The building shall be of a protected construction type (Type I, IIA, IIIA, IV or VA). All interior stairways shall be enclosed to comply with the requirements of 780 CMR for interior exitway stairways and shall discharge directly to the exterior of the building or into a code complying grade passageway or lobby. The building shall also be equipped with fire alarms complying with 780 CMR 9.00 for the appropriate use group classification; or*
3. *The Building shall comply with the provisions of 780 CMR 425.0; or*
4. *If of unprotected construction (Types IIB, IIIB or VB), the building shall be equipped with fire alarms complying with 780 CMR 9.00 for the appropriate use group classification. No Group Dwelling Unit(s) shall utilize portions of the building above the second story. All stories in the building shall be equipped with two approved, independent exitways. Interior exitway stairways shall be enclosed to comply with the requirements of 780 CMR for interior exitway stairways and shall discharge directly to the exterior of the building or into a code complying grade passageway or lobby; or*
5. *In those buildings of unprotected constructed (Types IIB, IIIB or VB) where enclosure of interior exitway stairways is impractical due to physical limitations of configuration of the building (e.g. split entry type stairways), the stairway(s) may be permitted to remain unenclosed, provided that all sleeping rooms are segregated from the open stairway by a minimum of one hour fire resistive construction and the exitways are arranged so that a second means of egress is available from each sleeping area which does not pass through the open stairway area. The building shall also be equipped with fire alarms complying with 780 CMR 9.00 for the appropriate use group classification. No Group Dwelling Unit shall utilize portions of the building above the second story. All stories in the building shall be equipped with two approved, independent exitways (even if the building is classified in Use Group R-3).*

427.2.1.1 Limitation on Location of Impaired Residents. All sleeping rooms of impaired residents shall either be located on the first story or on a story containing a horizontal exit complying with 780 CMR 1021.0.

427.2.2 Category B Unit Compliance Options. Buildings housing Group Dwelling Units classified as "Category B" shall comply with any one of the following compliance options:

1. *Any Category A compliance option; or*
2. *All stories in the building shall be provided with two approved, independent exitways. All interior stairways shall be enclosed to comply with the requirements of 780 CMR for interior exitway stairways and shall discharge directly to the exterior of the building or into a code complying grade passageway or lobby. The building also shall be equipped with fire alarms complying with 780 CMR 9.00 for the appropriate use group classification.*

427.2.3 Category C Unit Compliance Options. Buildings housing Group Dwelling Units classified as "Category C" shall comply with any one of the following compliance options:

1. *Any Category A compliance option; or*
2. *Any Category B compliance option; or*
3. *The building shall comply with the provisions of 780 CMR 421.0.*

427.3 Special Fire Safety Items.

427.3.1 Hazardous Contents. No contents which represent a fire hazard greater than that which could be expected of ordinary household furnishings shall be permitted within a Group Dwelling Unit.

427.3.2 Interior Finish. Interior finish in exitways and exitway access corridors shall be a minimum of Class II, unless the building is equipped with a fire suppression system. Approved fire retardant paints may be used to improve the interior finish classification of existing construction to satisfy this requirement.

427.3.3 Locks. Double cylinder deadbolt locks which require a key operation on the side from which egress is to be made are not permitted in Group Dwelling Units. Locks of any type are prohibited on sleeping room doors of impaired or partially impaired residents or on any door which provides access to an exitway.

427.4 Special Inspection/Fire Drill. Prior to occupancy of the group dwelling unit the Licensing Agency shall conduct a fire drill to test the capability of residents to exit according to their residency classification. At least once every 90 days, the Operating Agency shall also conduct a fire drill to test the capability of residents to exit according to their residency classification. Drills shall be held at unexpected times under varying *conditions to simulate the unpredictable nature of fire emergencies. The building official may, at his option, participate in or witness the fire drill, or may accept an affidavit from the Operating Agency attesting to the performance of each resident or prospective resident. The affidavit shall also specify the date, time and conditions of the drill, and shall list all participants and witnesses.*

427.4.1 Conduct of the Fire Drill. During the conduct of the drill, one exit shall be blocked to simulate a hazardous condition and the alarm system shall be activated. Successful performance for each resident shall be defined as his/her ability to exit the building, or where horizontal exits are provided to reach an area of refuge within 2½ minutes of the activation of the fire alarm system. Only those staff members who are normally on duty shall be allowed to assist residents, and the only assistance permitted shall be that which is provided by the staff of the Group Dwelling Unit consistent with the classification of each individual resident.

NON-TEXT PAGE

780 CMR 5.00

GENERAL BUILDING HEIGHTS AND AREAS

780 CMR 501.0 GENERAL

501.1 Scope. The provisions of 780 CMR 5.00 control the height and area of structures hereafter erected and additions to existing structures.

[F] 501.2 Premises Identification. Approved numbers or ad dresses shall be provided for new buildings in such a position as to be clearly visible and legible from the street or roadway fronting the property. Letters or numbers shall be a minimum three inches (76 mm) in height and stroke of minimum 0.5 inch (12.7 mm) of a contrasting color to the background itself.

780 CMR 502.0 DEFINITIONS

502.1 Definitions. The following words and terms shall, for the purposes of 780 CMR 5.00 and as used elsewhere in 780 CMR, have the meanings shown in 780CMR 502.0.

AREA, BUILDING. The area included within surrounding exterior walls (or exterior walls and fire walls) exclusive of vent shafts and courts. Areas of the building not provided with sur rounding walls shall be included in the building area if such areas are included within the horizontal projection of the roof or floor above.

BASEMENT. That portion of a building that is partly or completely below grade plane (See "Story above grade plane" in 780 CMR 202.0). A basement shall be considered as a story above grade plane where the finished surface of the floor above the basement is:

1. More than six feet (1829 mm) above grade plane;
2. More than six feet (1829 mm) above the finished ground level for more than 50% of the total building perimeter; or
3. More than 12 feet (3658 mm) above the finished ground level at any point.

GRADE PLANE. A reference plane representing the average of finished ground level adjoining the building at exterior walls. Where the finished ground level slopes away from the exterior walls, the reference plane shall be established by the lowest points within the area between the building and the lot line or, where the lot line is more than six feet (1829mm) from the building, between the building and a point six feet (1829mm) from the building.

HEIGHT, BUILDING. The vertical distance from grade plane to the average height of the highest roof surface.

HEIGHT, STORY. The vertical distance from top to top of two successive finished floor surfaces; and, for the topmost story, from the top of the floor finish to the top of the ceiling joists or, where there is not a ceiling, to the top of the roof rafters.

INDUSTRIAL EQUIPMENT PLATFORM. An un-occupied, elevated platform in an industrial occupancy used exclusively for mechanical systems or industrial process equipment, including the associated elevated walkways, stairs and ladders necessary to access the platform (see 780 CMR 505.5).

MEZZANINE. An intermediate level or levels between the floor and ceiling of any story with an aggregate floor area of not more than ⅓ of the area of the room or space in which the level or levels are located (see 780 CMR 505.0).

STORY. That portion of a building included between the upper surface of a floor and the upper surface of the floor or roof next above (also see "Basement" and "Mezzanine").

780 CMR 503.0 GENERAL HEIGHT AND AREA LIMITATIONS

503.1 General. The height and area for buildings of different construction types shall be governed by the intended use of the building and shall not exceed the limits in Table 503 except as modified hereafter. Each part of a building included within the exterior walls or the exterior walls and fire walls where provided shall be permitted to be a separate building.

503.1.1 Basements. Basements need not be included in the total allowable area provided they do not exceed the area permitted for a one-story building.

503.1.2 Special Industrial Occupancies. Buildings and structures designed to house low-hazard industrial pro cesses that require large areas and unusual heights to accommodate crane ways or special machinery and equipment including, among others, rolling mills; structural metal fabrication shops and foundries; or the production and distribution of electric, gas or steam power, shall be exempt from the height and area limitations of Table 503.

503.1.3 Buildings on Same Lot. Two or more buildings on the same lot shall be regulated as separate buildings or shall be considered as portions of one building if the height of each building and the aggregate area of buildings are within the limitations of Table 503 as modified by 780 CMR 504 and 506. The provisions of this code applicable to the aggregate building shall be applicable to each building.

503.1.4 Type I Construction. Buildings of Type I construction permitted to be of unlimited tabular heights and areas are not subject to the special requirements that allow unlimited area buildings in 780 CMR 507.0 or unlimited height in 780 CMR 503.1.2 and 504.3 or increased height and areas for other types of construction.

503.2 Party Walls. Any wall located on a lot line between adjacent buildings, which is used or adapted for joint service between the two buildings, shall be constructed as a fire wall in accordance with 780 CMR 705.0, without openings and shall create separate buildings.

TABLE 503 ALLOWABLE HEIGHT AND BUILDING AREAS

Height limitations shown as stories and feet above grade plane.
Area limitations as determined by the definition of "Area, building," per floor.

GROUP		TYPE OF CONSTRUCTION								
		TYPE I		TYPE II		TYPE III		TYPE IV	TYPE V	
		A	B	A	B	A	B	HT	A	B
	Hgt(feet) Hgt(S)	UL	160	65	55	65	55	65	50	40
A- 1	S	UL	5	3	2	3	2	3	2	1
	A	UL	UL	15,500	8,500	14,000	8,500	15,000	11,500	5,500
A- 2	S	UL	11	3	2	3	2	3	2	1
	A	UL	UL	15,500	9,500	14,000	9,500	15,000	11,500	6,000
A- 3	S	UL	11	3	2	3	2	3	2	1
	A	UL	UL	15,500	9,500	14,000	9,500	15,000	11,500	6,000
A- 4	S	UL	11	3	2	3	2	3	2	1
	A	UL	UL	15,500	9,500	14,000	9,500	15,000	11,500	6,000
A- 5	S	UL	UL	UL	UL	UL	UL	UL	UL	UL
	A	UL	UL	UL	UL	UL	UL	UL	UL	UL
B	S	UL	11	5	4	5	4	5	3	2
	A	UL	UL	37,500	23,000	28,500	19,000	36,000	18,000	9,000
E	S	UL	5	3	2	3	2	3	1	1
	A	UL	UL	26,500	14,500	23,500	14,500	25,500	18,500	9,500
F- 1	S	UL	11	4	2	3	2	4	2	1
	A	UL	UL	25,000	15,500	19,000	12,000	33,500	14,000	8,500
F- 2	S	UL	11	5	3	4	3	5	3	2
	A	UL	UL	37,500	23,000	28,500	18,000	50,500	21,000	13,000
H- 1	S	1	1	1	1	1	1	1	1	NP
	A	21,000	16,500	11,000	7,000	9,500	7,000	10,500	7,500	NP
H- 2	S	UL	3	2	1	2	1	2	1	1
	A	21,000	16,500	11,000	7,000	9,500	7,000	10,500	7,500	3,000
H-3	S	UL	6	4	2	4	2	4	2	1
	A	UL	60,000	26,500	14,000	17,500	13,000	25,500	10,000	5,000
H- 4	S	UL	7	5	3	5	3	5	3	2
	A	UL	UL	37,500	17,500	28,500	17,500	36,000	18,000	6,500
H- 5	S	3	3	3	3	3	3	3	3	2
	A	UL	UL	37,500	23,000	28,500	19,000	36,000	18,000	9,000
I- 1	S	UL	9	4	3	4	3	4	3	2
	A	UL	55,000	19,000	10,000	16,500	10,000	18,000	10,500	4,500
I- 2	S	UL	4	2	1	1	NP	1	1	NP
	A	UL	UL	15,000	11,000	12,000	NP	12,000	9,500	NP
I-3	S	UL	4	2	1	2	1	2	2	1
	A	UL	UL	15,000	10,000	10,500	7,500	12,000	7,500	5,000
I- 4	S	UL	5	3	2	3	2	3	1	1
	A	UL	60,500	26,500	13,000	23,500	13,000	25,500	18,500	9,000
M	S	UL	11	4	4	4	4	4	3	1
	A	UL	UL	21,500	12,500	18,500	12,500	20,500	14,000	9,000
R- 1	S	UL	11	4	4	4	4	4	3	2
	A	UL	UL	24,000	16,000	24,000	16,000	20,500	12,000	7,000
R- 2[a, d]	S	UL	11	4	4	4	4	4	3	2
	A	UL	UL	24,000	16.000	24,000	16,000	20,500	12,000	7,000
R-3[a]	S	UL	11	4	4	4	4	4	3	3
	A	UL	UL	UL	UL	UL	UL	UL	UL	UL
R-4	S	UL	11	4	4	4	4	4	3	2
	A	UL	UL	24,000	16,000	24,000	16,000	20,500	12,000	7,000
S- 1	S	UL	11	4	3	3	3	4	3	1
	A	UL	48,000	26,000	17,500	26,000	17.500	25,500	14,000	9,000
S-2b, [c]	S	UL	11	5	4	4	4	5	4	2
	A	UL	79,000	39,000	26,000	39,000	26,000	38,500	21,000	13,500
U[c]	S	UL	5	4	2	3	2	4	2	1
	A	UL	35,500	19,000	8,500	14,000	8,500	18,000	9,000	5,500

For SI: 1 foot = 304.8 mm, 1 square foot = 0.0929 m^2.
UL = Unlimited, NP = Not permitted.
a. As applicable in 780 CMR 101.2.
b. For open parking structures, see 780 CMR 406.3.
c. For private garages, see 780 CMR 406.1.
d. For purposes of allowable height and building area, Town Houses shall be treated as R-2 use.

780 CMR 504.0 HEIGHT MODIFICATIONS

504.1 General. The heights permitted by Table 503 shall only be increased in accordance with this 780 CMR.

Exception. The height of one-story aircraft hangars, aircraft paint hangars and buildings used for the manufacturing of aircraft shall not be limited if the building is provided with an automatic fire-extinguishing system in accordance with 780 CMR 9.00 and is entirely surrounded by public ways or yards not less in width than one and one-half times the height of the building.

504.2 Automatic Sprinkler System Increase. Where a building is equipped throughout with an approved automatic sprinkler system in accordance with 780 CMR 903.3.1.1, the value specified in Table 503 for maximum height is increased by 20 feet (6096 mm) and the maximum number of stories is increased by one story. These increases are permitted in addition to the area increase in accordance with 780 CMR 506.2 and 506.3. For Group R buildings equipped throughout with an approved automatic sprinkler system in accordance with 780 CMR 903.3.1.2, the value specified in Table 503 for maximum height is increased by 20 feet (6096 mm) and the maximum number of stories is increased by one story, but shall not exceed four stories or 60 feet (18 288 mm), respectively.

Exceptions:

1. Group I-2 of Type IIB, III, IV or V construction.
2. Group H-1, H-2, H-3 or H-5.
3. Fire-resistance rating substitution in accordance with Table 601, Note d.

504.3 Roof Structures. Towers, spires, steeples and other roof structures shall be constructed of materials consistent with the required type of construction of the building except where other construction is permitted by 780 CMR 1509.2.1. Such structures shall not be used for habitation or storage. The structures shall be unlimited in height if of noncombustible materials and shall not extend more than 20 feet (6096 mm) above the allowable height if of combustible materials (see 780 CMR 15.00 for additional requirements).

780 CMR 505.0 MEZZANINES

505.1 General. A mezzanine or mezzanines in compliance with 780 CMR 505.0 shall be considered a portion of the floor below. Such mezzanines shall not contribute to either the building area or number of stories as regulated by 780 CMR 503.1. The area of the mezzanine shall be included in determining the fire area defined in 780 CMR 702.0. The clear height above and below the mezzanine floor construction shall not be less than seven feet (2134 mm).

505.2 Area Limitation. The aggregate area of a mezzanine or mezzanines within a room shall not exceed ⅓ of the area of that room or space in which they are located. The enclosed portions of rooms shall not be included in a determination of the size of the room in which the mezzanine is located. In determining the allowable mezzanine area, the area of the mezzanine shall not be included in the area of the room.

Exception. The aggregate area of mezzanines in buildings and structures of Type I or II construction for special industrial occupancies in accordance with 780 CMR 503.1.2 shall not exceed ⅔ of the area of the room.

505.3 Egress. Each occupant of a mezzanine shall have access to at least two independent means of egress where the common path of egress travel exceeds the limitations of 780 CMR 1000.0. Where a stairway provides a means of exit access from a mezzanine, the maximum travel distance includes the distance traveled on the stairway measured in the plane of the tread nosing.

Exceptions:

1. A single means of egress shall be permitted in accordance with 780 CMR 1003.0.
2. Accessible means of egress shall be provided in accordance with 780 CMR 1007.0.

505.4 Openness. A mezzanine shall be open and unobstructed to the room in which such mezzanine is located except for walls not more than 42 inches (1067 mm) high, columns and posts.

Exceptions:

1. Mezzanines or portions thereof are not required to be open to the room in which the mezzanines are located, provided that the occupant load of the aggregate area of the enclosed space does not exceed ten.
2. A mezzanine having two or more means of egress is not required to be open to the room in which the mezzanine is located, if at least one of the means of egress provides direct access to an exit from the mezzanine level.
3. Mezzanines or portions thereof are not required to be open to the room in which the mezzanines are located, provided that the aggregate floor area of the enclosed space does not exceed 10% of the mezzanine area.
4. In industrial facilities, mezzanines used for control equipment are permitted to be glazed on all sides.
5. In Group F occupancies of unlimited area, meeting the requirements of 780 CMR 507.2 or 507.3, mezzanines or portions thereof are not required to be open to the room in which the mezzanines are located, provided that an approved fire alarm system is installed throughout the entire building or structure and notification appliances are installed throughout the mezzanines in accordance with the provisions of NFPA 72. In addition, the fire alarm system shall be initiated by

automatic sprinkler water flow.

505.5 Industrial Equipment Platforms. Industrial equipment platforms in buildings shall not be considered as a portion of the floor below. Such equipment platforms shall not contribute to either the building area or the number of stories as regulated by 780 CMR 503.1. The area of the industrial equipment platform shall not be included in determining the fire area. Industrial equipment platforms shall not be a part of any mezzanine, and such platforms and the walkways, stairs and ladders providing access to an equipment platform shall not serve as a part of the means of egress from the building.

505.5.1 Area Limitations. The aggregate area of all industrial equipment platforms within a room shall not exceed two-thirds of the area of the room in which they occur. Where an equipment platform is located in the same room as a mezzanine, the area of the mezzanine shall be determined by 780 CMR 505.2, and the combined aggregate area of the equipment platforms and mezzanines shall not exceed two-thirds of the room in which they occur.

505.5.2 Fire Suppression. Where located in a building that is required to be protected by an automatic sprinkler system, industrial equipment platforms shall be fully protected by sprinklers above and below the platform, where required by the standards referenced in 780 CMR 903.3.

505.5.3 Guards. Equipment platforms shall have guards where required by 780 CMR 1012.1.

780 CMR 506.0 AREA MODIFICATIONS

506.1 General. The areas limited by Table 503 shall be permitted to be increased due to frontage (I_f) and automatic sprinkler system protection (I_s) in accordance with the following:

Equation 5-1

$$A_a = A_t + \frac{A_t I_f}{100} + \frac{A_t I_s}{100}$$

where:

A_a = Allowable area per floor (square feet).

A_t = Tabular area per floor in accordance with Table 503 (square feet).

I_f = Area increase due to frontage (percent) as calculated in accordance with 780 CMR 506.2.

I_s = Area increase due to sprinkler protection (percent) as calculated in accordance with 780 CMR 506.3.

506.1.1 Basements. A single basement need not be included in the total allowable area provided such basement does not exceed the area permitted for a one-story building.

506.2 Frontage Increase. Every building shall adjoin or have access to a public way to receive an area increase for frontage.

Where a building has more than 25% of its perimeter on a public way or open space having a minimum width of 20 feet (6096 mm), the frontage increase shall be determined in accordance with the following:

Equation 5-2

$$I_f = 100\left[\frac{F}{P - 0.25}\right]\frac{W}{25}$$

where:

I_f = Area increase due to frontage.

F = Building perimeter which fronts on a public way or open space having 20 feet (6096 mm) open minimum width (feet).

P = Perimeter of entire building (feet).

W = Width of public way or open space (feet) in accordance with 780 CMR 506.2.1.

506.2.1 Width Limits. W must be at least 20 feet (6096 mm) and the quantity W divided by 30 shall not exceed 1.0. Where the value of W varies along the perimeter of the building, the calculation performed in accordance with Equation 5-2 shall be based on the weighted average of each portion of exterior wall and open space where the value of W is between 20 and 30 feet (6096 and 9144 mm).

Exception: The quantity W divided by 30 shall be permitted to not exceed 2.0 when all of the following conditions exist:

1. The building is permitted to be unlimited in area by 780 CMR 507.0; and
2. The only provision preventing unlimited area is compliance with the 60-foot (18 288 mm) public way or yard requirement, as applicable.

506.2.2 Open Space Limits. Such open space shall be either on the same lot or dedicated for public use and shall be accessed from a street or approved fire lane.

506.3 Automatic Sprinkler System Increase. Where a building is equipped throughout with an approved automatic sprinkler system in accordance with 780 CMR 903.3.1.1, the area limitation in Table 503 is permitted to be increased by an additional 200% (I_s = 200%) for multistory buildings and an additional 300% (I_s = 300%) for single-story buildings. These increases are permitted in addition to the height and story increases in accordance with 780 CMR 504.2.

Exceptions:

1. Buildings with an occupancy in Group H-1, H-2 or H-3.
2. Fire-resistance rating substitution in accordance with Table 601, Note d.

506.4 Area Determination. The maximum area of a building with more than one story shall be determined by multiplying the allowable area of the first floor (A_a), as determined in 780 CMR 506.1, by the number of stories as listed below.

1. For two-story buildings, multiply by 2;

2. For three-story or higher buildings, multiply by 3; and,
3. No story shall exceed the allowable area per floor (A_a), as determined in 780 CMR 506.1 for the occupancies on that floor.

Exceptions:
1. Unlimited area buildings in accordance with 780 CMR 507.0.
2. The maximum area of a building equipped throughout with an automatic sprinkler system in accordance with 780 CMR 903.3.1.2 shall be determined by multi plying the allowable area per floor (A_a), as determined in 780 CMR 506.1 by the number of stories.

780 CMR 507.0 UNLIMITED AREA BUILDINGS

507.1 Nonsprinklered, One Story. Reserved.

507.2 Sprinklered, One Story. The area of a one-story, Group B, F, M or S building or a one-story Group A-4 building of other than Type V construction shall not be limited when the building is provided with an automatic sprinkler system throughout in accordance with 780 CMR 903.3.1.1, and is surrounded and adjoined by public ways or yards not less than 60 feet (18 288 mm) in width.

Exceptions:
1. Buildings and structures of Type I and II construction for rack storage facilities which do not have access by the public shall not be limited in height provided that such buildings conform to the requirements of 780 CMR 507.1 and NFPA 13.
2. The automatic sprinkler system shall not be required in areas occupied for indoor participant sports, such as tennis, skating, swimming and equestrian activities, in occupancies in Group A-4, provided that:
    2.1. Exit doors directly to the outside are provided for occupants of the participant sports areas, and
    2.2. The building is equipped with a fire alarm system with manual fire alarm boxes installed in accordance with 780 CMR 907.0.

507.3 Two Story. Reserved.

507.4 Reduced Open Space. The permanent open space of 60 feet (18 288 mm) required in 780 CMR 507.1, 507.2 and 507.3 shall be permitted to be reduced to not less than 40 feet (12 192 mm) provided the following requirements are met:
1. The reduced open space shall not be allowed for more than 75% of the perimeter of the building.
2. The exterior wall facing the reduced open space shall have a minimum fire-resistance rating of three hours.
3. Openings in the exterior wall, facing the reduced open space, shall have opening protectives with a fire-resistance rating of three hours.

507.5 Group A-3 Buildings. The area of a one-story, Group A-3 building used as a church, community hall, dance hall, exhibition hall, gymnasium, lecture hall, indoor swimming pool or tennis court of Type I or II construction shall not be limited when all of the following criteria are met:
1. The building shall not have a stage other than a platform.
2. The building shall be equipped throughout with an automatic sprinkler system in accordance with 780 CMR 903.3.1. 1.
3. The assembly floor shall be located at or within 21 inches (533 mm) of street or grade level and all exits are provided with ramps complying with 780 CMR 1010.1 to the street or grade level.
4. The building shall be surrounded and adjoined by public ways or yards not less than 60 feet (18288mm) in width.

507.6 High-hazard Use Groups. Group H-2, H-3 and H-4 fire areas shall be permitted in unlimited area buildings having occupancies in Groups F and S, in accordance with the limitations of 780 CMR 507.0. Fire areas located at the perimeter of the unlimited area building shall not exceed 10% of the area of the building nor the area limitations specified in Table 503 as modified by 780 CMR 506.2, based upon the percentage of the perimeter of the fire area that fronts on a street or other unoccupied space. Other fire areas shall not exceed 25% of the area limitations specified in Table 503. Fire-resistance-rating requirements of fire barrier assemblies shall be in accordance with Table 302.3.2.

507.7 Aircraft Paint Hangar. The area of a one-story, Group H-2 aircraft paint hangar shall not be limited where such aircraft paint hangar complies with the provisions of 780 CMR 412.4 and is entirely surrounded by public ways or yards not less in width than one and one-half times the height of the building.

507.8 Group E Buildings. The area of a one-story Group E building of Type II, IIIA or IV construction shall not be limited when the following criteria are met:
1. Each classroom shall have not less than two means of egress, with one of the means of egress being a direct exit to the outside of the building complying with 780 CMR 1017.
2. The building is equipped throughout with an automatic sprinkler system in accordance with 780 CMR 903.3.1.1.
3. The building is surrounded and adjoined by public ways or yards not less than 60 feet (18 288 mm) in width.

507.9 Motion Picture Theaters. In buildings of Type I or II construction, the area of one-story motion picture theaters shall not be limited when the building is provided with an automatic sprinkler system throughout in accordance with 780 CMR 903.3.1.1 and is surrounded and adjoined by public ways or yards not less than 60 feet (18 288 mm) in width.

780 CMR 508.0 SPECIAL PROVISIONS

508.1 General. The provisions in 780 CMR 508.0 shall permit the use of special conditions that are exempt from, or modify, the specific requirements of 780 CMR 5.00 regarding the allowable heights and areas of buildings based on the occupancy classification and type of construction, provided the special condition complies with the provisions specified in780 CMR 508.0 for such condition and other applicable requirements of 780 CMR.

508.2 Group S-2 Enclosed Parking Garage with Group A, B, M or R Above. A basement and/or the first story above grade plane of a building shall be considered as a separate and distinct building for the purpose of determining area limitations, continuity of fire walls, limitation of number of stories and type of construction, when all of the following conditions are met:

1. The basement and/or the first story above grade plane is of Type IA construction and is separated from the building above with a horizontal assembly having a minimum three-hour fire-resistance rating.
2. Shaft, stairway, ramp or escalator enclosures through the horizontal assembly shall have not less than a two-hour fire-resistance rating with opening protectives in accordance with Table 715.3.

   Exception: Where the enclosure walls below the horizontal assembly have not less than a three-hour fire-resistance rating with opening protectives in accordance with Table 715.3, the enclosure walls extending above the horizontal assembly shall be permitted to have a one-hour fire-resistance rating provided:

   1. The building above the horizontal assembly is not required to be of Type I construction;
   2. The enclosure connects less than four stories, and
   3. The enclosure opening protectives above the horizontal assembly have a minimum one-hour fire protection rating.
   4. The building above the horizontal assembly contains only Group A having an assembly room with an occupant load of less than 300, or Group B, M or R; and
   5. The building below the horizontal assembly is a Group S-2 enclosed parking garage, used for the parking and storage of private motor vehicles.

      Exceptions:

      1. Entry lobbies, mechanical rooms and similar uses incidental to the operation of the building shall be permitted.
      2. Group A having an assembly room with an occupant load of less than 300, or Group B or M shall be permitted in addition to those uses incidental to the operation of the building (including storage areas), provided that the entire structure below the horizontal assembly is protected throughout by an approved automatic sprinkler system.

   6. The maximum building height in feet shall not exceed the limits set forth in Table 503 for the least restrictive type of construction involved.

508.3 Group S-2 Enclosed Parking Garage with Group S-2 Open Parking Garage Above. A Group S-2 enclosed parking garage located in the basement or first story below a Group S-2 open parking garage shall be classified as a separate and distinct building for the purpose of determining the type of construction when the following conditions are met:

1. The allowable area of the structure shall be such that the sum of the ratios of the actual area divided by the allowable area for each separate occupancy shall not exceed 1.0.
2. The Group S-2 enclosed parking garage is of Type I or II construction and is at least equal to the fire-resistance requirements of the Group S-2 open parking garage.
3. The height and the number of the floors above the basement shall be limited as specified in Table 406.3.5.
4. The floor assembly separating the Group S-2 enclosed parking garage and Group S-2 open parking garage shall be protected as required for the floor assembly of the Group S-2 enclosed parking garage. Openings between the Group S-2 enclosed parking garage and Group S-2 open parking garage, except exit openings, shall not be required to be protected.
5. The Group S-2 enclosed parking garage is used exclusively for the parking or storage of private motor vehicles, but shall be permitted to contain an office, waiting room and toilet room having a total area of not more than 1,000 square feet (93 m^2), and mechanical equipment rooms incidental to the operation of the building.

508.4 Parking Beneath Group R. Where a maximum one-story above grade plane Group S-2 parking garage, enclosed or open, or combination thereof, of Type I construction or open of Type IV construction, with grade entrance, is provided under a building of Group R, the number of stories to be used in determining the minimum type of construction shall be measured from the floor above such a parking area. The floor assembly between the parking garage and the Group R above shall comply with the type of construction required for the parking garage and shall also provide a fire-resistance rating not less than the mixed occupancy separation required in 780 CMR 302.3.3.

508.5 Group R-2 Buildings of Type IIIA Construction. The height limitation for buildings of Type IIIA construction in Group R-2 shall be increased to six stories and 75 feet (22 860 mm) where the first-floor construction above the basement has a fire-resistance rating of not less than 3 hours and the floor area is subdivided by 2-hour fire-resistance-rated fire walls into areas of not more than 3,000 square feet (279 m^2).

508.6 Group R-2 Buildings of Type IIA Construction. The height limitation for buildings of Type IIA construction in Group R-2 shall be increased to nine stories and 100 feet (30 480 mm) where the building is separated by not less than 50 feet (15 240 mm) from any other building on the lot and from property lines, the exits are segregated in an area enclosed by a two-hour fire-resistance-rated fire wall and the first-floor construction has a fire-resistance rating of not less than 1½ hours.

508.7 Open Parking Garage Beneath Groups A, I, B, M and R. Open parking garages constructed under Groups A, I, B, M and R shall not exceed the height and area limitations permitted under 780 CMR 406.3. The height and area of the portion of the building above the open parking garage shall not exceed the limitations in 780 CMR 503.0 for the upper occupancy. The height, in both feet and stories, of the portion of the building above the open parking garage shall be measured from grade plane and shall include both the open parking garage and the portion of the building above the parking garage.

508.7.1 Fire Separation. Fire separation assemblies between the parking occupancy and the upper occupancy shall correspond to the required fire-resistance rating prescribed in Table 302.3.3 for the uses involved. The type of construction shall apply to each occupancy individually, except that structural members, including main bracing within the open parking structure, which is necessary to support the upper occupancy, shall be protected with the more restrictive fire-resistance-rated assemblies of the groups involved as shown in Table 601. Means of egress for the upper occupancy shall conform to 780 CMR 10.00 and shall be separated from the parking occupancy by fire barriers having at least a two-hour fire-resistance rating as required by 780 CMR 706.0, with self-closing doors complying with 780 CMR 715.0. Means of egress from the open parking garage shall comply with 780 CMR 406.3.

NON-TEXT PAGE

780 CMR 6.00

TYPES OF CONSTRUCTION

780 CMR 601.0 GENERAL

601.1 Scope. The provisions of 780CMR 6.00 shall control the classification of buildings as to type of construction.

780 CMR 602.0 CONSTRUCTION CLASSIFICATION

602.1 General. Buildings and structures erected or to be erected, altered or extended in height or area shall be classified in one of the five construction types defined in 780 CMR 602.2 through 602.5. The building elements shall have a fire-resistance rating not less than that specified in Table 601 and exterior walls shall have a fire-resistance rating not less than that specified in Table 602.

602.1.1 Minimum Requirements. A building or portion thereof shall not be required to conform to the details of a type of construction higher than that type which meets the minimum requirements based on occupancy, even though certain features of such a building actually conform to a higher type of construction.

602.2 Types I and II. Type I and II construction are those types of construction in which the building elements listed in Table 601 are of noncombustible materials.

602.3 Type III. Type III construction is that type of construction in which the exterior walls are of noncombustible materials and the interior building elements are of any material permitted by 780 CMR. Fire-retardant-treated wood framing complying with 780 CMR 2303.10 shall be permitted within exterior wall assemblies of a two-hour rating or less.

602.4 Type IV. Type IV construction (Heavy Timber, HT) is that type of construction in which the exterior walls are of noncombustible materials and the interior building elements are of solid or laminated wood without concealed spaces. The details of Type IV construction shall comply with the provisions of 780 CMR 602.0. Fire-retardant-treated wood framing complying with 780 CMR 2303.10 shall be permitted within exterior wall assemblies with a two-hour rating or less.

602.4.1 Columns. Wood columns shall be sawn or glued laminated and shall not be less than eight inches (203 mm), nominal, in any dimension where supporting floor loads and not less than six inches (152 mm) nominal in width and not less than eight inches (203 mm) nominal in depth where supporting roof and ceiling loads only. Columns shall be continuous or superimposed and connected in an approved manner.

602.4.2 Floor Framing. Wood beams and girders shall be of sawn or glued-laminated timber and shall be not less than six inches (152 mm) nominal in width and not less than ten inches (254 mm) nominal in depth. Framed sawn or glued-laminated timber arches, which spring from the floor line and support floor loads, shall be not less than eight inches (203 mm) nominal in any dimension. Framed timber trusses supporting floor loads shall have members of not less than eight inches (203 mm) nominal in any dimension.

602.4.3 Roof Framing. Wood-frame or glued-laminated arches for roof construction, which spring from the floor line or from grade and do not support floor loads, shall have members not less than six inches (152 mm) nominal in width and have less than eight inches (203 mm) nominal in depth for the lower half of the height and not less than six inches (152 mm) nominal in depth for the upper half. Framed or glued- laminated arches for roof construction that spring from the top of walls or wall abutments, framed timber trusses and other roof framing, which do not support floor loads, shall have members not less than four inches (102 mm) nominal in width and not less than six inches (152 mm) nominal in depth. Spaced members shall be permitted to be composed of two or more pieces not less than three inches (76 mm) nominal in thickness where blocked solidly throughout their intervening spaces or where spaces are tightly closed by a continuous wood cover plate of not less than two inches (51 mm) nominal in thickness secured to the underside of the members. Splice plates shall be not less than three inches (76 mm) nominal in thickness. Where protected by approved automatic sprinklers under the roof deck, framing members shall be not less than three inches (76 mm) nominal in width.

602.4.4 Floors. Floors shall be without concealed spaces. Wood floors shall be of sawn or glued-laminated planks, splined or tongue-and-groove, of not less than three inches (76 mm) nominal in thickness covered with one-inch (25 mm) nominal dimension tongue-and-groove flooring, laid crosswise or diagonally, or 0.5-inch (12.7 mm) particleboard or planks not less than four inches (102 mm) nominal in width set on edge close together and well spiked and covered with one-inch (25 mm) nominal dimension flooring or $^{15}/_{32}$-inch (12 mm) wood structural panel or 0.5-inch (12.7 mm) particleboard. The lumber shall be laid so that no continuous line of joints will occur except at points of support. Floors shall not extend closer than 0.5 inch (12.7

mm) to walls. Such 0.5-inch (12.7 mm) space shall be covered by a molding fastened to the wall and so arranged that it will not obstruct the swelling or shrinkage movements of the floor. Corbeling of masonry walls under the floor shall be permitted to be used in place of molding.

602.4.5 Roofs. Roofs shall be without concealed spaces and wood roof decks shall be sawn or glued laminated, splined or tongue-and-groove plank, not less than two inches (51 mm) thick, 1⅛-inch-thick (32 mm) wood structural panel (exterior glue), or of planks not less than three inches (76 mm) nominal in width, set on edge close together and laid as required for floors. Other types of decking shall be permitted to be used if providing equivalent fire resistance and structural properties.

602.4.6 Partitions. Partitions shall be of solid wood construction formed by not less than two layers of one-inch (25 mm) matched boards or laminated construction four inches (102 mm) thick, or of one-hour fire-resistance-rated construction.

602.4.7 Exterior Structural Members. Where a horizontal separation of 20 feet (6096 mm) or more is provided, wood columns and arches conforming to heavy timber sizes shall be permitted to be used externally.

602.5 Type V. Type V construction is that type of construction in which the structural elements, exterior walls and interior walls are of any materials permitted by 780 CMR.

780 CMR 603.0 COMBUSTIBLE MATERIAL IN TYPE I AND II CONSTRUCTION

603.1 Allowable Materials. Combustible materials shall be permitted in buildings of Type I or II construction in the following applications and in accordance with 780 CMR 603.1.1 through 603.1.3:

1. Fire-retardant-treated wood shall be permitted in:
   - 1.1. Nonbearing partitions where the required fire-resistance rating is 2 hours or less.
   - 1.2. Nonbearing exterior walls where no fire rating is required.
   - 1.3. Roof construction as permitted in Table 601, Note c., Item 3.
2. Thermal and acoustical insulation, other than foam plastics, having a flame spread index of not more than 25.

   Exceptions:

   1. Insulation placed between two layers of noncombustible materials without an intervening airspace shall be allowed to have a flame spread index of not more than 100.
   2. Insulation installed between a finished floor and solid decking without intervening airspace shall be allowed to have a flame spread index of not more than 200.
3. Foam plastics in accordance with 780 CMR 26..00
4. Roof coverings that have an A, B or C classification.
5. Interior floor finish and interior finish, trim and millwork such as doors, door frames, window sashes and frames.
6. Where not installed over 15 feet (4572 mm) above grade, show windows, nailing or furring strips, wooden bulkheads below show windows, their frames, aprons and show cases.
7. Finished flooring applied directly to the floor slab or to wood sleepers that are firestopped in accordance with 780 CMR 717.2.7.
8. Partitions dividing portions of stores, offices or similar places occupied by one tenant only and which do not establish a corridor serving an occupant load of 30 or more shall be permitted to be constructed of fire-retardant-treated wood, one-hour fire-resistance-rated construction or of wood panels or similar light construction up to six feet (1829 mm) in height.
9. Platforms as permitted in 780 CMR 410.0.
10. Combustible exterior wall coverings, balconies, bay or oriel windows, or similar appendages in accordance with 780 CMR 14.00.
11. Blocking such as for handrails, millwork, cabinets, and window and door frames.
12. Light-transmitting plastics as permitted by 780 CMR 26.00
13. Mastics and caulking materials applied to provide flexible seals between components of exterior wall construction.
14. Exterior plastic veneer installed in accordance with 780 CMR 2605.2.
15. Nailing or furring strips as permitted by 780 CMR 803.4.
16. Heavy timber as permitted by Note c, Item 2, to Table 601 and 780 CMR 602.4.7 and 1406.3.
17. Aggregates, component materials and admixtures as permitted by 780 CMR 703.2.2.
18. Sprayed cementitious and mineral fiber fire-resistance-rated materials installed to comply with 780 CMR 1705.0.
19. Materials used to protect penetrations in fire-resistance-rated assemblies in accordance with 780 CMR 712.0.
20. Materials used to protect joints in fire-resistance-rated assemblies in accordance with 780 CMR 713.0.
21. Materials allowed in the concealed spaces of buildings of Type I and II construction in accordance with 780 CMR 717.5.
22. Materials exposed within plenums complying with the *International Mechanical Code*, section 602.

603.1.1 Ducts. The use of nonmetallic ducts shall be permitted when installed in accordance with the limitations of the *International Mechanical Code.*

603.1.2 Piping. The use of combustible piping materials shall be permitted when installed in accordance with the limitations of the International Mechanical Code or the Massachusetts Fuel Gas and Plumbing Code (248 CMR), when applicable.

603.1.3 Electrical. The use of electrical wiring methods with combustible insulation, tubing, raceways and related components shall be permitted when installed in accordance with the limitations of the Massachusetts Electrical Code (527 CMR 12).

TABLE 601
FIRE-RESISTANCE RATING REQUIREMENTS FOR BUILDING ELEMENTS (hours)

BUILDING ELEMENT	TYPE I		TYPE II		TYPE III		TYPE IV	TYPE V	
	A	B	A[d]	B	A[d]	B	HT	A[d]	B
Structural frame[a] Including columns, girders, trusses	3[b]	2[b]	1	0	1	0	HT	1	0
Bearing walls Exterior[f] Interior	3 3[b]	2 2[b]	11	0	21	20	2 1/HT	11	0
Nonbearing walls and partitions Exterior	See Table 602								
Nonbearing walls and partitions Interior[e]	0	0	0	0	0	0	See 780 CMR 602.4.6	0	0
Floor construction Including supporting beams and joists	2	2	1	0	1	0	HT	1	0
Roof construction Including supporting beams and joists	1½[c]	1[c]	1[c]	0[c]	1[c]	0	HT	1[c]	0

For SI: 1 foot = 304.8 mm.

a. The structural frame shall be considered to be the columns and the girders, beams, trusses and spandrels having direct connections to the columns and bracing members designed to carry gravity loads. The members of floor or roof panels which have no connection to the columns shall be considered secondary members and not a part of the structural frame.

b. Roof supports: Fire-resistance ratings of structural frame and bearing walls are permitted to be reduced by one hour where supporting a roof only.

c. 1. Except in Factory-Industrial (F-1), Hazardous (H), Mercantile (M) and Moderate-Hazard Storage (S-1) occupancies, fire protection of structural members shall not be required, including protection of roof framing and decking where every part of the roof construction is 20 feet or more above any floor immediately below. Fire-retardant-treated wood members shall be allowed to be used for such unprotected members.
   2. In all occupancies, heavy timber shall be allowed where a one-hour or less fire-resistance rating is required.
   3. In Type I and II construction, fire-retardant-treated wood shall be allowed in buildings including girders and trusses as part of the roof construction when the building is:
      i. Two stories or less in height;
      ii. Type II construction over two stories; or
      iii. Type I construction over two stories and the vertical distance from the upper floor to the roof is 20 feet or more.

d. An approved automatic sprinkler system in accordance with 780 CMR 903.3.1.1 shall be allowed to be substituted for one-hour fire-resistance-rated construction, provided such system is not otherwise required by other provisions of 780 CMR or used for an allowable area increase in accordance with 780 CMR 506.3 or an allowable height increase in accordance with 780 CMR 504.2. The one-hour substitution for the fire resistance of exterior walls shall not be permitted.

e. Not less than the fire-resistance rating required by other sections of 780 CMR.

f. Not less than the fire-resistance rating based on fire separation distance (see Table 602).

TABLE 602
FIRE-RESISTANCE RATING REQUIREMENTS FOR EXTERIOR WALLS BASED ON FIRE SEPARATION DISTANCE

FIRE SEPARATION DISTANCE (feet)	TYPE OF CONSTRUCTION	OCCUPANCY GROUP H	OCCUPANCY GROUP F-1, M, S-1	OCCUPANCY GROUP A, B, E, F-2, I, R[b], S-2, U
< 5[c]	All	3	2	1
≥5 <1	IA	3	2	1
	Others	2	1	1
≥10 < 30	IA, IB	2	1	1
	IIB, VB	1	0	0
	Others	1	1	1
≥ 30	All	0	0	0

For SI: 1 foot = 304.8 mm.

a. Load-bearing exterior walls shall also comply with the fire-resistance rating requirements of Table 601.

b. Group R-3 and Group U when used as accessory to Group R-3, as applicable in 780 CMR 101.2 shall not be required to have a fire-resistance rating where the fire separation distance is three feet or more.

c. See 780 CMR 503.2 for party walls.

780 CMR 7.00

FIRE-RESISTANCE-RATED CONSTRUCTION

780 CMR 701.0 GENERAL

701.1 Scope. The provisions of 780 CMR 7.00 shall govern the materials and assemblies used for structural fire resistance and fire-resistance-rated construction separation of adjacent spaces to safeguard against the spread of fire and smoke within a building and the spread of fire to or from buildings.

780 CMR 702.0 DEFINITIONS

702.1 Definitions. The following words and terms shall, for the purposes of 780 CMR 7.00, and as used elsewhere in 780 CMR, have the meanings shown in 780 CMR 702.1.

ANNULAR SPACE. The opening around the penetrating item.

CEILING RADIATION DAMPER. A listed device installed in a ceiling membrane of a fire-resistance-rated floor/ceiling or roof/ceiling assembly to limit automatically the radiative heat transfer through an air inlet/outlet opening.

COMBINATION FIRE/SMOKE DAMPER. A listed device installed in ducts and air transfer openings designed to close automatically upon the detection of heat and to also resist the passage of air and smoke. The device is installed to operate automatically, controlled by a smoke detection system, and where required, is capable of being positioned from a remote command station.

DAMPER. See "Ceiling radiation damper," "Combination fire/smoke damper," "Fire damper" and "Smoke damper."

DRAFTSTOP. A material, device or construction installed to restrict the movement of air within open spaces of concealed areas of building components such as crawl spaces, floor/ceiling assemblies, roof/ceiling assemblies and attics.

F RATING. The time period that the through-penetration firestop system limits the spread of fire through the penetration when tested in accordance with ASTM E 814.

FIRE AREA. The aggregate floor area enclosed and bounded by fire walls, fire barriers, exterior walls or fire-resistance-rated horizontal assemblies of a building.

FIRE BARRIER. A fire-resistance-rated vertical or horizontal assembly of materials designed to restrict the spread of fire in which openings are protected.

FIRE DAMPER. A listed device, installed in ducts and air transfer openings of an air distribution system or smoke control system, designed to close automatically upon detection of heat, to interrupt migratory airflow, and to restrict the passage of flame. Fire dampers are classified for use in either static systems that will automatically shut down in the event of a fire, or in dynamic systems that continue to operate during a fire. A dynamic fire damper is tested and rated for closure under airflow.

FIRE DOOR. The door component of a fire door assembly.

FIRE DOOR ASSEMBLY. Any combination of a fire door, frame, hardware, and other accessories that together provide a specific degree of fire protection to the opening.

FIRE PARTITION. A vertical assembly of materials designed to restrict the spread of fire in which openings are protected.

FIRE PROTECTION RATING. The period of time that an opening protective assembly will maintain the ability to confine a fire as determined by tests prescribed in 780 CMR 715.0. Ratings are stated in hours or minutes.

FIRE RESISTANCE. That property of materials or their assemblies that prevents or retards the passage of excessive heat, hot gases or flames under conditions of use.

FIRE-RESISTANCE RATING. The period of time a building element, component or assembly maintains the ability to confine a fire, continues to perform a given structural function, or both, as determined by the tests, or the methods based on tests, prescribed in 780 CMR 703.

FIRE-RESISTANT JOINT SYSTEM. An assemblage of specific materials or products that are designed, tested, and fire-resistance rated in accordance with either ASTM E 1966 or UL 2079 to resist for a prescribed period of time the passage of fire through joints made in or between fire-resistance-rated assemblies.

FIRE SEPARATION DISTANCE. The distance measured from the building face to the closest interior lot line, to the centerline of a street, alley or public way, or to an imaginary line between two buildings on the lot. The distance shall be measured at right angles from the face of the wall.

FIRE WALL. A fire-resistance-rated wall having protected openings, which restricts the spread of fire and extends continuously from the foundation to or through the roof, with sufficient structural stability under fire conditions to allow collapse of construction on either side without collapse of the wall.

FIRE WINDOW ASSEMBLY. A window constructed and glazed to give protection against the passage of fire.

FIREBLOCKING. Building materials installed to resist the free passage of flame to other areas of the building through concealed spaces.

FLOOR FIRE DOOR ASSEMBLY. A combination of a fire door, a frame, hardware and other accessories installed in a horizontal plane, which together provide a specific degree of fire protection to a through opening in a fire-resistance-rated floor (see 780 CMR 712.4.6).

JOINT. The linear opening in or between adjacent fire-resistance-rated assemblies that is designed to allow independent movement of the building in any plane caused by thermal, seismic, wind or any other loading.

MEMBRANE PENETRATION. An opening made through one side (wall, floor or ceiling membrane) of an assembly.

MEMBRANE-PENETRATION FIRESTOP. A material, device or construction installed to resist for a prescribed time period the passage of flame and heat through openings in a protective membrane in order to accommodate cables, cable trays, conduit, tubing, pipes or similar items.

PENETRATION FIRESTOP. A through-penetration firestop or a membrane-penetration firestop.

SELF-CLOSING. As applied to a fire door or other opening, means equipped with an approved device that will ensure closing after having been opened.

SHAFT. An enclosed space extending through one or more stories of a building, connecting vertical openings in successive floors, or floors and roof.

SHAFT ENCLOSURE. The walls or construction forming the boundaries of a shaft.

SMOKE BARRIER. A continuous membrane, either vertical or horizontal, such as a wall, floor, or ceiling assembly, that is designed and constructed to restrict the movement of smoke.

SMOKE COMPARTMENT. A space within a building enclosed by smoke barriers on all sides, including the top and bottom.

SMOKE DAMPER. A listed device installed in ducts and air transfer openings that is designed to resist the passage of air and smoke. The device is installed to operate automatically, controlled by a smoke detection system, and where required, is capable of being positioned from a remote command station.

SPLICE. The result of a factory and/or field method of joining or connecting two or more lengths of a fire-resistant joint system into a continuous entity.

T RATING. The time period that the penetration firestop system, including the penetrating item, limits the maximum temperature rise to 325°F (163°C) above its initial temperature through the penetration on the nonfire side when tested in accordance with ASTM E 814.

THROUGH PENETRATION. An opening that passes through an entire assembly.

THROUGH-PENETRATION FIRESTOP SYSTEM. An assemblage of specific materials or products that are designed, tested and fire-resistance rated to resist for a prescribed period of time the spread of fire through penetrations. The F and T rating criteria for penetration firestop systems shall be in accordance with ASTM E 814. See definitions of "F rating" and "T rating."

780 CMR 703.0 FIRE-RESISTANCE RATINGS AND FIRE TESTS

703.1 Scope. Materials prescribed herein for fire resistance shall conform to the requirements of 780 CMR 7.00.

703.2 Fire-resistance Ratings. The fire-resistance rating of building elements shall be determined in accordance with the test procedures set forth in ASTM E 119 or in accordance with 780 CMR 703.3. Where materials, systems or devices that have not been tested as part of a fire-resistance-rated assembly are incorporated into the assembly, sufficient data shall be made available to the building official to show that the required fire-resistance rating is not reduced. Materials and methods of construction used to protect joints and penetrations in fire-resistance-rated building elements shall not reduce the required fire-resistance rating.

> **Exception.** In determining the fire-resistance rating of exterior bearing walls, compliance with the ASTM E 119 criteria for unexposed surface temperature rise and ignition of cotton waste due to passage of flame or gases is required only for a period of time corresponding to the required fire-resistance rating of an exterior nonbearing wall with the same fire separation distance, and in a building of the same group. When the fire-resistance rating determined in accordance with this exception exceeds the fire-resistance rating

determined in accordance with ASTM E 119, the fire exposure time period, water pressure, and application duration criteria for the hose stream test of ASTM E 119 shall be based upon the fire-resistance rating determined in accordance with this exception.

703.2.1 Nonsymmetrical Wall Construction. Interior walls and partitions of nonsymmetrical construction shall be tested with both faces exposed to the furnace, and the assigned fire-resistance rating shall be the shortest duration obtained from the two tests conducted in compliance with ASTM E 119. When evidence is furnished to show that the wall was tested with the least fire-resistant side exposed to the furnace, subject to acceptance of the building official, the wall need not be subjected to tests from the opposite side (*see* 780 CMR 704.5 for exterior walls).

703.2.2 Combustible Components. Combustible aggregates are permitted in gypsum and portland cement concrete mixtures approved for fire-resistance-rated construction. Any approved component material or admixture is permitted in assemblies if the resulting tested assembly meets the fire-resistance test requirements of 780 CMR.

703.2.3 Restrained Classification. Fire-resistance-rated assemblies tested under ASTM E 119 shall not be considered to be restrained unless evidence satisfactory to the building official is furnished by the registered design professional showing that the construction qualifies for a restrained classification in accordance with ASTM E 119. Restrained construction shall be identified on the plans.

703.3 Alternative Methods for Determining Fire Resistance. The application of any of the alternative methods listed in 780 CMR 703.3. shall be based on the fire exposure and acceptance criteria specified in ASTM E 119. The required fire resistance of a building element shall be permitted to be established by any of the following methods or procedures:

1. Fire-resistance designs documented in approved sources.
2. Prescriptive designs of fire-resistance-rated building elements as prescribed in 780 CMR 720.0.
3. Calculations in accordance with 780 CMR 721.0.
4. Engineering analysis based on a comparison of building element designs having fire-resistance ratings as determined by the test procedures set forth in ASTM E 119.
5. Alternative protection methods as allowed by 780 CMR 104.11.

703.4 Noncombustibility Tests. The tests indicated in 780 CMR 703.4.1 and 703.4.2 shall serve as criteria for acceptance of building materials as set forth in 780 CMR 602.2, 602.3 and 602.4 in Type I, II, III and IV construction. The term "noncombustible" does not apply to the flame spread characteristics of interior finish or trim materials. A material shall not be classified as a noncombustible building construction material if it is subject to an increase in combustibility or flame spread beyond the limitations herein established through the effects of age, moisture or other atmospheric conditions.

703.4.1 Elementary Materials. Materials required to be noncombustible shall be tested in accordance with ASTM E 136.

703.4.2 Composite Materials. Materials having a structural base of noncombustible material as determined in accordance with 780 CMR 703.4.1 with a surfacing not more than 0.125 inch (3.18 mm) thick that has a flame spread index not greater than 50 when tested in accordance with ASTM E 84 shall be acceptable as noncombustible materials.

703.5 Spray-applied Fire Resistive Materials.

703.5.1 Thickness, Density and Bond Strength. For cementitious and fibrous spray-applied fire resistive materials, the thickness and density shall be determined in accordance with ASTM E605 as referenced in 780 CMR 35.00. The cohesive/ adhesive bond strength shall be determined in accordance with the field testing set forth in ASTM E736 as referenced in 780 CMR 35.00 and field test samples shall be selected to provide representative samples from every floor, wall and roof assembly, beams, columns, girders trusses, joists, etc., at the rate of at least one sample for every 10,000 ft² or part thereof from every story of the building or structure.

703.5.1.1 Thickness, Detail. ***For cementitious and fibrous spray-applied fire resistive materials applied to structural components, the thickness (average thickness) of such spray-applied fire-resistive materials shall not be less than the thickness required by the approved fire resistance design and the fire resistance design shall be identified in the Construction Documents.***

703.5.1.2 Density, Detail. ***For cementitious and fibrous spray-applied fire resistive materials applied to structural components, the density of such spray-applied fire-resistive materials shall not be less than the density required by the approved fire resistance design.***

703.5.1.3 Bond Strength, Detail. ***For cementitious and fibrous spray-applied fire resistive materials applied to structural components, the cohesive/adhesive bond strength of the cured spray-applied fire resistive material shall be not less than 150 psf.***

780 CMR 704.0 EXTERIOR WALLS

704.1 General. Exterior walls shall be fire-resistance rated and have opening protection as required by 780 CMR 704.0.

704.2 Projections. Cornices, eave overhangs, exterior balconies and similar architectural appendages extending beyond the floor area shall conform to the requirements of 780 CMR 704.0 and 780 CMR 1406.0. Exterior egress balconies and exterior exit stairways shall also comply with 780 CMR 1013.5 and 1022.1. Projections shall not extend beyond the distance determined by the following two methods, whichever results in the lesser projection:

1. A point ⅓ the distance to the lot line from an assumed vertical plane located where protected openings are required in accordance with 780 CMR 704.8.
2. More than 12 inches (305 mm) into areas where openings are prohibited.

704.2.1 Type I and II Construction. Projections from walls of Type I or II construction shall be of noncombustible materials or combustible materials as allowed by 780 CMR 1406.3 and 1406.4.

704.2.2 Type III, IV or V Construction. Projections from walls of Type III, IV or V construction shall be of any approved material.

704.2.3 Combustible Projections. Combustible projections located where openings are not permitted or where protection of openings is required shall be of at least one-hour fire-resistance-rated construction, Type IV construction or as required by 780 CMR 1406.3.

Exception. Type V construction shall be allowed for R-3 occupancies, as applicable in 780 CMR 101.2.

704.3 Buildings on the Same Lot. For the purposes of determining the required wall and opening protection and roof-covering requirements, buildings on the same lot shall be assumed to have an imaginary line between them.

Where a new building is to be erected on the same lot as an existing building, the location of the assumed imaginary line with relation to the existing building shall be such that the exterior wall and opening protection of the existing building meet the criteria as set forth in 780 CMR 704.5 and 704.8.

Exception. Two or more buildings on the same lot shall either be regulated as separate buildings or shall be considered as portions of one building if the aggregate area of such buildings is within the limits specified in 780 CMR 5.00 for a single building. Where the buildings contain different occupancy groups or are of different types of construction, the area shall be that allowed for the most restrictive occupancy or construction.

704.4 Materials. Exterior walls shall be of materials permitted by the building type of construction.

704.5 Fire-resistance Ratings. Exterior walls shall be fire-resistance rated in accordance with Tables 601 and 602. The fire-resistance rating of exterior walls with a fire separation distance of greater than five feet (1524 mm) shall be rated for exposure to fire from the inside. The fire-resistance rating of exterior walls with a fire separation distance of five feet (1524 mm) or less shall be rated for exposure to fire from both sides.

704.6 Structural Stability. The wall shall extend to the height required by 780 CMR 704.11 and shall have sufficient structural stability such that it will remain in place for the duration of time indicated by the required fire-resistance rating.

704.7 Unexposed Surface Temperature. Where protected openings are not limited by 780 CMR 704.8, the limitation on the rise of temperature on the unexposed surface of exterior walls as required by ASTM E 119 shall not apply. Where protected openings are limited by 780 CMR 704.8, the limitation on the rise of temperature on the unexposed surface of exterior walls as required by ASTM E 119 shall not apply provided that a correction is made for radiation from the unexposed exterior wall surface in accordance with the following formula:

Equation 7-1

$$A_e = A + (A_f \times F_{eo})$$

where:

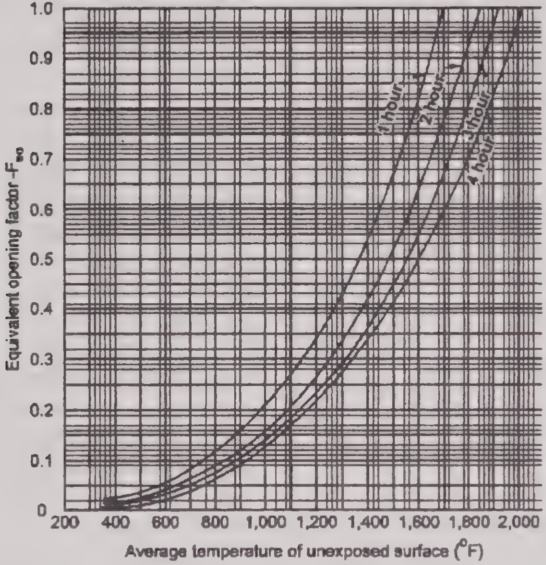
A_e=Equivalent area of protected openings.

A =Actual area of protected openings.

A_f=Area of exterior wall surface in the story under consideration exclusive of openings, on which the temperature limitations of ASTM E119 listed in ***Appendix A*** for walls are exceeded.

F_{eo}= An "equivalent opening factor" derived from Figure 704.7 based on the average temperature of the unexposed wall surface and the fireresistance rating of the wall.

Figure 704.7
EQUIVALENT OPENING FACTOR



For SI: °C = [(°F) - 32] / 1.8.

704.8 Allowable Area of Openings. The maximum area of unprotected or protected openings permitted in an exterior wall in any story shall not exceed the values set forth in Table 704.8. Where both unprotected and protected openings are located in the exterior wall in any story, the total area of the openings shall comply with the following formula:

Equation 7-2

$$A/a + A_u/a_u \leq 1.0$$

where:

A = Actual area of protected openings, or the equivalent area of protected openings A_e (see 780 CMR 7047).

a = Allowable area of protected openings.

A_u = Actual area of unprotected openings.

a_u = Allowable area of unprotected openings.

TABLE 704.8 MAXIMUM AREA OF EXTERIOR WALL OPENINGS[a]

CLASSIFICATION OF OPENING	FIRE SEPARATION DISTANCE (feet)							
	0 to 3[e,h]	> than 3 to 5[b]	> than 5 to 10[d,f]	> than 10 to 15[c,d,f]	> than 15 to 20[c,f]	> than 20 to 25[c,f]	> than 25 to 30[c,f]	> than 30
Unprotected	Not Permitted[g]	Permitted[b,g]	10%g	15%[g]	25%[g]	45%[g]	70%[g]	No Limit
Protected	Not Permitted	15%	25%	45%	75%	No Limit	No Limit	No Limit

For SI: 1 foot = 304.8 mm.

a. Values given are percentage of the area of the exterior wall.

b. For occupancies in Group R-3, as applicable in 780 CMR 101.2, the maximum percentage of unprotected and protected exterior wall openings shall be 25%.

c. The area of openings in an open parking structure with a fire separation distance of greater than ten feet shall not be limited.

d. For occupancies in Group 11-2 or 11-3, unprotected openings shall not be permitted for openings with a fire separation distance of 15 feet or less.

e. For requirements for fire walls for buildings with differing roof heights, see 780 CMR 705 .6.1.

f. The area of unprotected and protected openings is not limited for occupancies in Group R-3, as applicable in 780 CMR 101.2, with a fire separation distance greater than five feet.

g. Buildings whose exterior bearing wall, exterior nonbearing wall and exterior structural frame are not required to be fire-resistance rated shall be permitted to have unlimited unprotected openings.

h. Includes accessory buildings to Group R-3 as applicable in 780 CMR 101.2.

704.8.1 Automatic Sprinkler System. In buildings equipped throughout with an automatic sprinkler system in accordance with 780 CMR 903.3.1.1, the maximum allowable area of unprotected openings in occupancies other than Groups H-1, H-2 and H-3 shall be the same as the tabulated limitations for protected openings.

704.8.2 First Story. In occupancies other than Group H, unlimited unprotected openings are permitted in the first story of exterior walls facing a street that have a fire separation distance of greater than 15 feet (4572 mm), or facing an unoccupied space. The unoccupied space shall be on the same lot or dedicated for public use, shall not be less than 30 feet (9144 mm) in width, and shall have access from a street by a posted fire lane having a width of not less than 20 feet (6096 mm).

704.9 Vertical Separation of Openings. Openings in exterior walls in adjacent stories shall be separated vertically to protect against fire spread on the exterior of the buildings where the openings are within five feet (1524 mm) of each other horizontally and the opening in the lower story is not a protected opening in accordance with 780 CMR 715.4.8. Such openings shall be separated vertically at least three feet (914 mm) by spandrel girders, exterior walls or other similar assemblies that have a fire-resistance rating of at least one hour or by flame barriers that extend horizontally at least 30 inches (762 mm) beyond the exterior wall. Flame barriers shall also have a fire-resistance rating of at least one hour. The unexposed surface temperature limitations specified in ASTM E 119 shall not apply to the flame barriers or vertical separation unless otherwise required by the provisions of 780 CMR.

Exceptions:
1. 780 CMR 704.9 shall not apply to buildings that are three stories or less in height.
2. 780 CMR 704.9 shall not apply to buildings equipped throughout with an automatic sprinkler system in accordance with 780 CMR 903.3.1.1 or 903.3.1.2.
3. Open parking garages.

704.10 Vertical Exposure. For buildings on the same lot, approved protectives shall be provided in every opening that is less than 15 feet (4572 mm) vertically above the roof of an adjoining building or adjacent structure that is within a horizontal fire separation distance of 15 feet (4572 mm) of the wall in which the opening is located.

Exception. Opening protectives are not required where the roof construction has a fire-resistance rating of not less than one hour for a minimum distance of ten feet (3048 mm) from the adjoining building and the entire length and span of the supporting elements for the fire-resistance-rated roof assembly has a fire-resistance rating of not less than one hour.

704.11 Parapets. Parapets shall be provided on exterior walls of buildings.

Exceptions: A parapet need not be provided on an exterior wall where any of the following conditions exist:
1. The wall is not required to be fire-resistance rated in accordance with Table 602 because of fire separation distance.
2. The building has an area of not more than 1,000 square feet (93 m^2) on any floor.
3. Walls that terminate at roofs of not less than two-hour fire-resistance-rated construction or where the roof, including the deck and supporting construction, is constructed entirely of noncombustible materials.
4. One-hour fire-resistance-rated exterior walls that terminate at the underside of the roof sheathing, deck or slab, provided:
   4.1. Where the roof/ceiling framing elements are parallel to the walls, such framing and elements supporting such framing shall not be of less than one-hour fire-resistance-rated construction for a width of four feet (1220 mm) measured from the interior side of the wall for Groups R and U and ten feet (3048 mm) for other occupancies.
   4.2. Where roof/ceiling framing elements are not parallel to the wall, the entire span of such framing and elements supporting such framing shall not be of less than one-hour fire-resistance-rated construction.
   4.3. Openings in the roof shall not be located within five feet (1524 mm) of the one-hour fire-resistance-rated exterior wall for Groups R and U and ten feet (3048 mm) for other occupancies.
   4.4. The entire building shall be provided with not less than a Class B roof covering.
5. In occupancies of Groups R-2 and R-3 as applicable in 780 CMR 101.2, both provided with a Class C roof covering, the exterior wall shall be permitted to terminate at the roof sheathing or deck in Type III, IV and V construction provided:
   5.1. The roof sheathing or deck is constructed of approved noncombustible materials or of fire-retardant-treated wood, for a distance of four feet (1220 mm); or
   5.2. The roof is protected with 0.625-inch (15.88 mm) Type X gypsum board directly beneath the underside of the roof sheathing or deck, supported by a minimum of nominal two-inch (51 mm) ledgers attached to the sides of the roof framing members, for a minimum distance of four feet (1220 mm).

6. Where the wall is permitted to have at least 25% of the exterior wall areas containing unprotected openings based on fire separation distance as determined in accordance with 780 CMR 704.8.

704.11.1 Parapet Construction. Parapets shall have the same fire-resistance rating as that required for the supporting wall, and on any side adjacent to a roof surface, shall have noncombustible faces for the uppermost 18 inches (457 mm), including counterflashing and coping materials. The height of the parapet shall not be less than 30 inches (762 mm) above the point where the roof surface and the wall intersect. Where the roof slopes toward a parapet at a slope greater than two units vertical in 12 units horizontal (16.7% slope), the parapet shall extend to the same height as any portion of the roof within a fire separation distance where protection of wall openings is required, but in no case shall the height be less than 30 inches (762 mm).

704.12 Opening Protection. Windows required to be protected in accordance with 780 CMR 704.8, 704.9, or 704.10 shall comply with 780 CMR 715.4.8. Other openings required to be protected with fire doors or shutters in accordance with 780 CMR 704.8, 704.9 and 704.10 shall comply with 780 CMR 715.3.

Exception. Fire protective assemblies are not required where the building is protected throughout by an automatic sprinkler system and the exterior openings are protected by an approved water curtain using automatic sprinklers approved for that use. The sprinklers and the water curtain shall be installed in accordance with NFPA 13.

704.12.1 Unprotected Openings. Where protected openings are not required by 780 CMR 704.0, windows and doors shall be constructed of any approved materials. Glazing shall conform to the requirements of 780 CMR 24.0 and 26.0.

704.13 Joints. Joints made in or between exterior walls required by 780 CMR 704.13 to have a fire-resistance rating shall comply with 780 CMR 713.0. Exception: Joints in exterior walls that are permitted to have unprotected openings.

704.13.1 Voids. The void created at the intersection of a floor/ceiling assembly and an exterior curtain wall assembly shall be protected in accordance with 780 CMR 713.4.

704.14 Ducts and Air Transfer Openings. Penetrations by air ducts and air transfer openings in fire-resistance-rated exterior walls required to have protected openings shall comply with 780 CMR 716.0.

Exception. Foundation vents installed in accordance with 780 CMR are permitted.

780 CMR 705.0 FIRE WALLS

705.1 General. Each portion of a building separated by one or more fire walls that comply with the provisions of 780 CMR 705.0 shall be considered a separate building. The extent and location of such fire walls shall provide a complete separation. Where a fire wall also separates groups that are required to be separated by a fire barrier wall, the most restrictive requirements of each separation shall apply. Fire walls located on lot lines shall also comply with 780 CMR 503.2. Such fire walls (party walls) shall be constructed without openings.

705.2 Structural Stability. Fire walls shall have sufficient structural stability under fire conditions to allow collapse of construction on either side without collapse of the wall for the duration of time indicated by the required fire-resistance rating.

705.3 Materials. Fire walls shall be of any approved noncombustible materials.

Exception: Buildings of Type V construction.

705.4 Fire-resistance rating. Fire walls shall have a fire-resistance rating of not less than that required by Table 705.4.

TABLE 705.4
FIRE WALL FIRE-RESISTANCE RATINGS

OCCUPANCY GROUP	FIRE-RESISTANCE RATING (hours)
A, B, E, H-4, I, R-1, R-2, U	3[a]
F-1, H-3[b], H-5, M, S-1	3
H-1, H-2	4[b]
F-2, S-2, R-3, R-4	2

a. Walls shall be not less than two-hour fire-resistance rated where separating buildings of Type II or V construction.

b. For Group H-1, H-2 or H-3 buildings, also see 780 CMR 415.4 and 415.5.

705.5 Horizontal Continuity. Fire walls shall be continuous from exterior wall to exterior wall and shall extend at least 18 inches (457 mm) beyond the exterior surface of exterior walls.

Exceptions:

1. Fire walls shall be permitted to terminate at the interior surface of combustible exterior sheathing or siding provided the exterior wall has a fire-resistance rating of at least one hour for a horizontal distance of at least four feet (1220 mm) on both sides of the fire wall. Openings within such exterior walls shall be protected by fire assemblies having a fire protection rating of not less than ¾ hour.
2. Fire walls shall be permitted to terminate at the interior surface of noncombustible exterior sheathing, exterior siding or other noncombustible exterior finishes provided the sheathing, siding, or other exterior noncombustible finish extends a horizontal distance of at least four feet (1220 mm) on both sides of the fire wall.

3. Fire walls shall be permitted to terminate at the interior surface of noncombustible exterior sheathing where the building on each side of the fire wall is protected by an automatic sprinkler system installed in accordance with 780 CMR 903.3.1.1 or 903.3.1.2.

705.5.1 Exterior Walls. Where the fire wall intersects the exterior walls, the fire-resistance rating for the exterior walls on both sides of the fire wall shall have a one-hour fire-resistance rating with ¾-hour opening protection where opening protection is required. The fire-resistance rating of the exterior wall shall extend a minimum of four feet (1220 mm) on each side of the intersection of the fire wall to exterior wall. Exterior wall intersections at fire walls that form an angle equal to or greater than 180 degrees (3.14 rad) do not need exterior wall protection.

705.5.2 Horizontal Projecting Elements. Fire walls shall extend to the outer edge of horizontal projecting elements such as balconies, roof overhangs, canopies, marquees and architectural projections that are within four feet (1220 mm) of the fire wall.

Exceptions:

1. Horizontal projecting elements without concealed spaces provided the exterior wall behind and below the projecting element has not less than one-hour fire-resistance-rated construction for a distance not less than the depth of the projecting element on both sides of the fire wall. Openings within such exterior walls shall be protected by fire assemblies having a fire protection rating of not less than ¾ hour.
2. Noncombustible horizontal projecting elements with concealed spaces, provided a minimum one-hour fire-resistance-rated wall extends through the concealed space. The projecting element shall be separated from the building by a minimum of one-hour fire-resistance-rated construction for a distance on each side of the fire wall equal to the depth of the projecting element. The wall is not required to extend under the projecting element where the building exterior wall is not less than one-hour fire-resistance rated for a distance on each side of the fire wall equal to the depth of the projecting element. Openings within such exterior walls shall be protected by fire assemblies having a fire protection rating of not less than ¾ hour.
3. For combustible horizontal projecting elements with concealed spaces, the fire wall need only extend through the concealed space to the outer edges of the projecting elements. The exterior wall behind and below the projecting element shall be of not less than one-hour fire-resistance-rated construction for a distance not less than the depth of the projecting elements on both sides of the fire wall. Openings within such exterior walls shall be protected by fire assemblies having a fire-protection rating of not less than ¾ hour.

705.6 Vertical Continuity. Fire walls shall extend from the foundation to a termination point at least 30 inches (762 mm) above both adjacent roofs.

Exceptions:

1. Stepped buildings in accordance with 780 CMR 705.6.1.
2. Two-hour fire-resistance-rated walls shall be permitted to terminate at the underside of the roof sheathing, deck or slab provided:
    2.1. The lower roof assembly within four feet (1220 mm) of the wall has not less than a one-hour fire-resistance rating and the entire length and span of supporting elements for the rated roof assembly has a fire-resistance rating of not less than one hour.
    2.2. Openings in the roof shall not be located within four feet (1220 mm) of the fire wall.
    2.3. Each building shall be provided with not less than a Class B roof covering.
3. Walls shall be permitted to terminate at the underside of noncombustible roof sheathing, deck, or slabs where both buildings are provided with not less than a Class B roof covering. Openings in the roof shall not be located within four feet (1220 mm) of the fire wall.
4. In buildings of Type III, IV and V construction, walls shall be permitted to terminate at the underside of combustible roof sheathing or decks provided:
    4.1. There are no openings in the roof within four feet (1220 mm) of the fire wall,
    4.2. The roof is covered with a minimum Class B roof covering, and
    4.3. The roof sheathing or deck is constructed of fire-retardant-treated wood for a distance of four feet (1220 mm) on both sides of the wall or the roof is protected with ⅝ inch (15.9 mm) Type X gypsum board directly beneath the underside of the roof sheathing or deck, supported by a minimum of two-inch (51 mm) nominal ledgers attached to the sides of the roof framing members for a minimum distance of four feet (1220 mm) on both sides of the fire wall.
5. Buildings located above a parking garage designed in accordance with 780 CMR 508.2 shall be permitted to have the fire walls for the buildings located above the parking garage extend from the horizontal separation between the parking garage and the buildings.

705.6.1 Stepped Buildings. Where a fire wall serves as an exterior wall for a building and separates buildings having different roof levels, such wall shall terminate at a point not less than 30 inches (762 mm) above the lower roof level, provided the exterior wall for a height of 15 feet

(4572 mm) above the lower roof is not less than one-hour fire-resistance-rated construction from both sides with openings protected by assemblies having a ¾-hour fire protection rating.

Exception. Where the fire wall terminates at the underside of the roof sheathing, deck or slab of the lower roof, provided:

1. The lower roof assembly within ten feet (3048 mm) of the wall has not less than a one-hour fire-resistance rating and the entire length and span of supporting elements for the rated roof assembly has a fire-resistance rating of not less than one hour.
2. Openings in the lower roof shall not be located within ten feet (3048 mm) of the fire wall.

705.7 Combustible Framing in Fire Walls. Adjacent combustible members entering into a concrete or masonry fire wall from opposite sides shall not have less than a four-inch (102 mm) distance between embedded ends. Where combustible members frame into hollow walls or walls of hollow units, hollow spaces shall be solidly filled for the full thickness of the wall and for a distance not less than four inches (102 mm) above, below and between the structural members, with noncombustible materials approved for fireblocking.

705.8 Openings. Each opening through a fire wall shall be protected in accordance with 780 CMR 715.3 and shall not exceed 120 square feet (11 m^2). The aggregate width of openings at any floor level shall not exceed 25% of the length of the wall.

Exceptions:

1. Openings are not permitted in party walls constructed in accordance with 780 CMR 503.2.
2. Openings shall not be limited to 120 square feet (11 m^2) where both buildings are equipped throughout with an automatic sprinkler system installed in accordance with 780 CMR 903.3.1.1.

705.9 Penetrations. Penetrations through fire walls shall comply with 780 CMR 712.

705.10 Joints. Joints made in or between fire walls shall comply with 780 CMR 713.

705.11 Ducts and Air Transfer Openings. Ducts and air transfer openings shall not penetrate fire walls.

Exception: Penetrations by ducts and air transfer openings of fire walls that are not on a lot line shall be allowed provided the penetrations comply with 780 CMR 712 and 716. The size and aggregate width of all openings shall not exceed the limitations of 780 CMR 705.8.

780 CMR 706.0 FIRE BARRIERS

706.1 General. Fire barriers used for separation of shafts, exits, exit passageways, horizontal exits or incidental use areas, to separate different occupancies, to separate a single occupancy into different fire areas, or to separate other areas where a fire barrier is required elsewhere in 780 CMR or the *International Fire Code*, shall comply with 780 CMR 706.0.

706.2 Materials. The walls and floor assemblies shall be of materials permitted by the building type of construction.

706.3 Fire-resistance Rating. The fire-resistance rating of the walls and floor assemblies shall comply with 780 CMR 706.3.

706.3.1 Shaft Enclosures. The fire-resistance rating of the fire barrier separating building areas from a shaft shall comply with 780 CMR 707.4.

706.3.2 Exit Enclosures. The fire-resistance rating of the fire barrier separating building areas from an exit shall comply with 780 CMR 1019.1.

706.3.3 Exit Passageway. The fire-resistance rating of the separation between building areas and an exit passageway shall comply with 780 CMR 1020.1.

706.3.4 Horizontal Exit. The fire-resistance rating of the separation between building areas connected by a horizontal exit shall comply with 780 CMR 1021.1.

706.3.5 Incidental Use Areas. The fire barrier separating incidental use areas shall have a fire-resistance rating of not less than that indicated in Table 302.1.1.

706.3.6 Separation of Mixed Occupancies. Where the provisions of 780 CMR 302.3.2 are applicable, the fire barrier separating mixed occupancies shall have a fire-resistance rating of not less than that indicated in 780 CMR 302.3.2 based on the occupancies being separated.

706.3.7 Single-occupancy Fire Areas. The fire barrier separating a single occupancy into different fire areas shall have a fire-resistance rating of not less than that indicated in Table 706.3.7.

TABLE 706.3.7
FIRE-RESISTANCE RATING REQUIREMENTS FOR FIRE BARRIER ASSEMBLIES BETWEEN FIRE AREAS

OCCUPANCY GROUP	FIRE-RESISTANCE RATING (hours)
H-1, H-2	4
F-1, H-3, S-1	3
A, B, E, F-2, H-4, H-5, I, M, R, S-2	2
U	1

706.4 Continuity of Fire Barrier Walls. Fire barrier walls shall extend from the top of the floor/ceiling assembly below to the underside of the floor or roof slab or deck above and shall be securely attached thereto. These walls shall be continuous through concealed spaces such as the space above a suspended ceiling. The supporting construction for fire barrier walls shall be protected to afford the required fire-resistance rating of the fire barrier supported except for one-hour fire-resistance-rated incidental use area separations as required by Table 302.1.1 in buildings of Type IIB, IIIB and VB construction. Hollow vertical spaces within the fire barrier wall shall be firestopped at every floor level.

Exceptions:

1. The maximum required fire-resistance rating for assemblies supporting fire barriers separating tank storage as provided for in 780 CMR 415.7.2.1 shall be two hours, but not less than required by Table 601 for the building construction type.
2. Shaft enclosure shall be permitted to terminate at a top enclosure complying with 780 CMR 707.12.

706.5 Horizontal Fire Barriers. Horizontal fire barriers shall be constructed in accordance with 780 CMR 711.

706.6 Exterior Walls. Where exterior walls serve as a part of a required fire-resistance-rated enclosure, such walls shall comply with the requirements of 780 CMR 704 for exterior walls and the fire-resistance-rated enclosure requirements shall not apply.

Exception. Exterior walls required to be fire-resistance rated in accordance with 780 CMR 1022.6.

706.7 Openings. Openings in a fire barrier wall shall be protected in accordance with 780 CMR 715. Openings shall be limited to a maximum aggregate width of 25% of the length of the wall, and the maximum area of any single opening shall not exceed 120 square feet (11 m^2). Openings in exit enclosures shall also comply with 780 CMR 1019.1.1.

Exceptions:

1 Openings shall not be limited to 120 square feet (11 m^2) where adjoining fire areas are equipped throughout with an automatic sprinkler system in accordance with 780 CMR 903.3.1.1.

2 Fire doors serving an exit enclosure.

3. Openings shall not be limited to 120 square feet (11 m^2) or an aggregate width of 25% of the length of the wall where the opening protective assembly has been tested in accordance with ASTM E 119 and has a minimum fire-resistance rating not less than the fire-resistance rating of the wall.

706.8 Penetrations. Penetrations through fire barriers shall comply with 780 CMR 712.

706.8.1 Prohibited Penetrations. Penetrations into an exit enclosure shall only be allowed when permitted by 780 CMR 1019.1.2.

706.9 Joints. Joints made in or between fire barriers shall comply with 780 CMR 713.

706.10 Ducts and Air Transfer Openings. Penetrations by ducts and air transfer openings shall comply with 780 CMR 712 and 716.

780 CMR 707.0 SHAFT ENCLOSURES

707.1 General. The provisions of 780 CMR 707.0 shall apply to vertical shafts where such shafts are required to protect openings and penetrations through floor/ceiling and roof/ceiling assemblies.

707.2 Shaft Enclosure Required. Openings through a floor/ceiling assembly shall be protected by a shaft enclosure complying with 780 CMR 707.0.

Exceptions:

1. A shaft enclosure is not required for openings totally within an individual residential dwelling unit and connecting four stories or less.
2. A shaft enclosure is not required in a building equipped throughout with an automatic sprinkler system in accordance with 780 CMR 903.3.1.1 for an escalator opening or stairway which is not a portion of the means of egress protected according to 780 CMR 707.2.1 or 2.2:
   - 2.1. Where the area of the floor opening between stories does not exceed twice the horizontal projected area of the escalator or stairway and the opening is protected by a draft curtain and closely spaced sprinklers in accordance with NFPA 13. In other than Groups B and M, this application is limited to openings that do not connect more than four stories.
   - 2.2. Where the opening is protected by approved power-operated automatic shutters at every floor penetrated. The shutters shall be of noncombustible construction and have a fire-resistance rating of not less than 1.5 hours. The shutter shall be so constructed as to close immediately upon the actuation of a smoke detector installed in accordance with 780 CMR 907.10 and shall completely shut off the well opening. Escalators shall cease operation when the shutter begins to close. The shutter shall operate at a speed of not more than 30 feet per minute (152.4 mm/s) and shall be equipped with a sensitive leading edge to arrest its progress where in contact with any obstacle, and to continue its progress on release there from.
3. A shaft enclosure is not required for penetrations by pipe, tube, conduit, wire, cable, and vents protected in accordance with 780 CMR 712.4.
4. A shaft enclosure is not required for penetrations by ducts protected in accordance with

780 CMR 712.4. Grease ducts shall be protected in accordance with the *International Mechanical Code*.

5. A shaft enclosure is not required for floor openings complying with the provisions for covered malls or atriums.
6. A shaft enclosure is not required for approved masonry chimneys, where annular space protection is provided at each floor level in accordance with 780 CMR 717.2.5.
7. In other than Groups I-2 and I-3, a shaft enclosure is not required for a floor opening that complies with the following:
   7.1. Does not connect more than two stories.
   7.2. Is not part of the required means of egress system except as permitted in 780 CMR 1019.1.
   7.3. Is not concealed within the building construction.
   7.4. Is not open to a corridor in Group I and R occupancies.
   7.5. Is not open to a corridor on non-sprinklered floors in any occupancy.
   7.6. Is separated from floor openings serving other floors by construction conforming to required shaft enclosures.
8. A shaft enclosure is not required for automobile ramps in open parking garages and enclosed parking garages constructed in accordance with 780 CMR 406.3 and 406.4, respectively.
9. A shaft enclosure is not required for floor openings between a mezzanine and the floor below.
10. A shaft enclosure is not required for joints protected by a fire-resistant joint system in accordance with 780 CMR 713.
11. Where permitted by other sections of 780 CMR.

707.3 Materials. The shaft enclosure shall be of materials permitted by the building type of construction.

707.4 Fire-resistance Rating. Shaft enclosures shall have a fire-resistance rating of not less than two hours where connecting four stories or more and not less than1 hour where connecting less than four stories. The number of stories connected by the shaft enclosure shall include any basements but not any mezzanines. Shaft enclosures shall be constructed as fire barriers in accordance with 780 CMR 706. Shaft enclosures shall have a fire-resistance rating not less than the floor assembly penetrated, but need not exceed two hours.

707.5 Continuity. Shaft enclosure walls shall extend from the top of the floor/ceiling assembly below to the underside of the floor or roof slab or deck above and shall be securely attached thereto. These walls shall be continuous through concealed spaces such as the space above a suspended ceiling. The supporting construction shall be protected to afford the required fire-resistance rating of the element supported. Hollow vertical spaces within the shaft enclosure construction wall shall be firestopped at every floor level.

707.6 Exterior Walls. Where exterior walls serve as a part of a required shaft enclosure, such walls shall comply with the requirements of 780 CMR 704 for exterior walls and the fire-resistance-rated enclosure requirements shall not apply.

Exception. Exterior walls required to be fire-resistance rated in accordance with 780 CMR 1022.6.

707.7 Openings. Openings in a shaft enclosure shall be protected in accordance with 780 CMR 715 as required for fire barriers. Such openings shall be self-closing or automatic-closing by smoke detection.

707.7.1 Prohibited Openings. Openings other than those necessary for the purpose of the shaft shall not be permitted in shaft enclosures.

707.8 Penetrations. Penetrations in a shaft enclosure shall be protected in accordance with 780 CMR 712.0 as required for fire barriers.

707.8.1 Prohibited Penetrations. Penetrations other than those necessary for the purpose of the shaft shall not be permitted in shaft enclosures. Ducts shall not penetrate exit shaft enclosures.

Exception. Duct penetrations as permitted in 780 CMR 1019.1.2.

707.9 Joints. Joints in a shaft enclosure shall comply with 780 CMR 713.

707.10 Ducts and Air Transfer Openings. Penetrations of a shaft enclosure by ducts and air transfer openings shall comply with 780 CMR 712.0 and 716.0.

707.11 Enclosure at the Bottom. Shafts that do not extend to the bottom of the building or structure shall:

1. Be enclosed at the lowest level with construction of the same fire-resistance rating as the lowest floor through which the shaft passes, but not less than the rating required for the shaft enclosure;
2. Terminate in a room having a use related to the purpose of the shaft. The room shall be separated from the remainder of the building by construction having a fire-resistance rating and opening protectives at least equal to the protection required for the shaft enclosure; or
3. Be protected by approved fire dampers installed in accordance with their listing at the lowest floor level within the shaft enclosure.

Exceptions:

1. The fire-resistance-rated room separation is not required provided there are no openings in

or penetrations of the shaft enclosure to the interior of the building except at the bottom. The bottom of the shaft shall be closed off around the penetrating items with materials permitted by 780 CMR 717.3.1 for draft-stopping, or the room shall be provided with an approved automatic fire suppression system.

2. A shaft enclosure containing a refuse chute or laundry chute shall not be used for any other purpose and shall terminate in a room protected in accordance with 780 CMR 707.13.4.

3. The fire-resistance-rated room separation and the protection at the bottom of the shaft are not required provided there are no combustibles in the shaft and there are no openings or other penetrations through the shaft enclosure to the interior of the building.

707.12 Enclosure at the Top. A shaft enclosure that does not extend to the underside of the roof deck of the building shall be enclosed at the top with construction of the same fire-resistance rating as the topmost floor penetrated by the shaft, but not less than the fire-resistance rating required for the shaft enclosure.

707.13 Refuse and Laundry Chutes. Refuse and laundry chutes, access and termination rooms and incinerator rooms shall meet the requirements of 780 CMR 707.13.1 through 707.13.6.

Exception. Chutes serving and contained within a single dwelling unit.

707.13.1 Refuse and Laundry Chute Enclosures. A shaft enclosure containing a refuse or laundry chute shall not be used for any other purpose and shall be enclosed in accordance with 780 CMR 707.4. Openings into the shaft, including those from access rooms and termination rooms, shall be protected in accordance with 780 CMR 707.13 and 780 CMR 715.0. Openings into chutes shall not be located in exit access corridors. Opening protectives shall be self-closing or automatic-closing upon the actuation of a smoke detector installed in accordance with 780 CMR 907.10, except that heat-activated closing devices shall be permitted between the shaft and the termination room.

707.13.2 Materials. A shaft enclosure containing a refuse or laundry chute shall be constructed of materials as permitted by the building type of construction.

707.13.3 Refuse and Laundry Chute Access Rooms. Access openings for refuse and laundry chutes shall be located in rooms or compartments completely enclosed by construction that has a fire-resistance rating of not less than one hour and openings into the access rooms shall be protected by opening protectives having a fire protection rating of not less than ¾ hour and shall be self-closing or automatic-closing upon the detection of smoke.

707.13.4 Termination Room. Refuse and laundry chutes shall discharge into an enclosed room completely separated from the remainder of the building by construction that has a fire-resistance rating of not less than one hour and openings into the termination room shall be protected by opening protectives having a fire protection rating of not less than ¾ hour and shall be self-closing or automatic-closing upon the detection of smoke. Refuse chutes shall not terminate in an incinerator room. Refuse and laundry rooms that are not provided with chutes need only comply with Table 302.1.1.

707.13.5 Incinerator Room. Incinerator rooms shall comply with Table 302.1.1.

707.13.6 Automatic Fire Sprinkler System. An approved automatic fire sprinkler system shall be installed in accordance with 780 CMR 903.2.10.2.

707.14 Elevator and Dumbwaiter Shafts. Elevator hoistway and dumbwaiter enclosures shall be constructed in accordance with 780 CMR 707.4 and 780 CMR 30.00

707.14.1 Elevator Lobby. Elevators opening into a fire-resistance-rated corridor as required by 780 CMR 1016.1 shall be provided with an elevator lobby at each floor containing such a corridor. The lobby shall separate the elevators from the corridor by fire partitions and the required opening protection. Elevator lobbies shall have at least one means of egress complying with 780 CMR 10.00 and other provisions within 780 CMR.

Exceptions:

1. In office buildings, separations are not required from a street-floor elevator lobby provided the entire street floor is equipped with an automatic sprinkler system in accordance with 780 CMR 903.3.1.1.

2. Elevators not required to be located in a shaft in accordance with 780 CMR 707.2.

3. Where additional doors are provided in accordance with 780 CMR 3002.6. Such doors shall be tested in accordance with UL 1784 without an artificial bottom seal.

4. In other than Group I-3, and buildings more than four stories above the lowest level of fire department vehicle access, lobby separation is not required where the building, including the lobby and corridors leading to the lobby, is protected by an automatic sprinkler system installed throughout in accordance with 780 CMR 903.3.1.1 or 903.3.1.2.

780 CMR 708.0 FIRE PARTITIONS

708.1 General. The following wall assemblies shall comply with 780 CMR 708.0.

1. Walls separating dwelling units in the same building.
2. Walls separating sleeping units in occupancies in Group R-1, hotel occupancies, R-2 and I-1.
3. Walls separating tenant spaces in covered mall buildings as required by 780 CMR 402.7.2.
4. Corridor walls as required by 780 CMR 1016.1.
5. Elevator lobby separation as required by 780 CMR 707.14.1.

708.2 Materials. The walls shall be of materials permitted by the building type of construction.

708.3 Fire-resistance Rating. The fire-resistance rating of the walls shall be at least one hour.

Exceptions:

1. Corridor walls as permitted by Table 1016.1.
2. Dwelling unit and sleeping unit separations in buildings of Type IIB, IIIB and VB construction shall have fire-resistance ratings of not less than ½ hour in buildings equipped throughout with an automatic sprinkler system in accordance with 780 CMR 903.3.1.1.

708.4 Continuity. Fire partitions shall extend from the top of the floor assembly below to the underside of the floor or roof slab or deck above or to the fire-resistance-rated floor/ceiling or roof/ceiling assembly above, and shall be securely attached thereto. If the partitions are not continuous to the deck, and where constructed of combustible construction, the space between the ceiling and the deck above shall be fireblocked or draftstopped in accordance with 780 CMR 717.2.1 and 717.3.1 at the partition line. The supporting construction shall be protected to afford the required fire-resistance rating of the wall supported, except for tenant and sleeping unit separation walls and exit access corridor walls in buildings of Type IIB, IIIB and VB construction.

Exceptions:

1. The wall need not be extended into the crawl space below where the floor above the crawl space has a minimum one-hour fire-resistance rating.
2. Where the room-side fire-resistance-rated membrane of the corridor is carried through to the underside of a fire-resistance-rated floor or roof above, the ceiling of the corridor shall be permitted to be protected by the use of ceiling materials as required for a one-hour fire-resistance-rated floor or roof system.
3. Where the corridor ceiling is constructed as required for the corridor walls, the walls shall be permitted to terminate at the upper membrane of such ceiling assembly.
4. The fire partition separating tenant spaces in a mall, complying with 780 CMR 402.7.2, is not required to extend beyond the underside of a ceiling that is not part of a fire-resistance-rated assembly. A wall is not required in attic or ceiling spaces above tenant separation walls.
5. Fireblocking or draftstopping is not required at the partition line in Group R-2 buildings that do not exceed four stories in height provided the attic space is subdivided by draftstopping into areas not exceeding 3,000 square feet (279 m^2) or above every two dwelling units, whichever is smaller.
6. Fireblocking or draftstopping is not required at the partition line in buildings equipped with an automatic sprinkler system installed throughout in accordance with 780 CMR 903.3.1.1 or 903.3.1.2 provided that automatic sprinklers are installed in combustible floor/ceiling and roof/ceiling spaces.

708.5 Exterior Walls. Where exterior walls serve as a part of a required fire-resistance-rated enclosure, such walls shall comply with the requirements of 780 CMR 704.0 for exterior walls and the fire-resistance-rated enclosure requirements shall not apply.

708.6 Openings. Openings in a fire partition shall be protected in accordance with 780 CMR 715.0.

708.7 Penetrations. Penetrations through fire partitions shall comply with 780 CMR 712.0.

708.8 Joints. Joints made in or between fire partitions shall comply with 780 CMR 713.0.

708.9 Ducts and Air Transfer Openings. Penetrations by ducts and air transfer openings shall comply with 780 CMR 712.0 and 716.0.

780 CMR 709.0 SMOKE BARRIERS

709.1 General. Smoke barriers shall comply with 780 CMR 709.0.

709.2 Materials. Smoke barriers shall be of materials permitted by the building type of construction.

709.3 Fire-resistance Rating. A one-hour fire-resistance rating is required for smoke barriers.
Exception: Smoke barriers constructed of minimum 0.10-inch-thick (2.5 mm) steel in Group I-3 buildings.

709.4 Continuity. Smoke barriers shall form an effective membrane continuous from outside wall to outside wall and from floor slab to floor or roof deck above, including continuity through concealed spaces, such as those found above suspended ceilings, and interstitial structural and mechanical spaces. The supporting construction shall be protected to afford the required fire-resistance rating of the wall or floor supported in buildings of other than Type IIB, IIIB or VB construction.

Exception. Smoke barrier walls are not required in interstitial spaces where such spaces are designed and constructed with ceilings that provide resistance to the passage of fire and smoke equivalent to that provided by the smoke barrier walls.

709.5 Openings. Openings in a smoke barrier shall be protected in accordance with 780 CMR 715.

Exception. In Group I-2, where such doors are installed across corridors, a pair of opposite-swinging doors without a center mullion shall be installed having vision panels with approved fire-resistance-rated glazing materials in approved fire-resistance-rated frames, the area of which shall not exceed that tested. The doors shall be close fitting within operational tolerances, and shall not have undercuts, louvers or grilles. The doors shall have head and jamb stops, astragals or rabbets at meeting edges and automatic-closing devices. Positive-latching devices are not required.

709.6 Penetrations. Penetrations through smoke barriers shall comply with 780 CMR 712.

709.7 Joints. Joints made in or between smoke barriers shall comply with 780 CMR 713.

709.8 Ducts and Air Transfer Openings. Penetrations by ducts and air transfer openings shall comply with 780CMR 712.0 and 716.0.

780 CMR 710.0 SMOKE PARTITIONS

710.1 General. Smoke partitions installed as required elsewhere in the code shall comply with 780 CMR 710.0.

710.2 Materials. The walls shall be of materials permitted by the building type of construction.

710.3 Fire-resistance Rating. Unless required elsewhere in the code, smoke partitions are not required to have a fire-resistance rating.

710.4 Continuity. Smoke partitions shall extend from the floor to the underside of the floor or roof deck above or to the underside of the ceiling above where the ceiling membrane is constructed to limit the transfer of smoke.

710.5 Openings. Windows shall be sealed to resist the free passage of smoke or be automatic-closing upon detection of smoke. Doors in smoke partitions shall comply with 780 CMR 710.5.

710.5.1 Louvers. Doors in smoke partitions shall not include louvers.

710.5.2 Smoke and Draft-control Doors. Where required elsewhere in the code, doors in smoke partitions shall be tested in accordance with UL 1784 with an artificial bottom seal installed across the full width of the bottom of the door assembly. The air leakage rate of the door assembly shall not exceed 3.0 cubic feet per minute per square foot [$ft^3/(min\ ft^2)$] ($0.015424\ m^3/sm^2$) of door opening at 0.10 inch (24.9 Pa) of water for both the ambient temperature test and the elevated temperature exposure test.

710.5.3 Self-closing or Automatic-closing Doors. Where required elsewhere in the code, doors in smoke partitions shall be self-closing or automatic-closing in accordance with 780 CMR 715.3.7.3.

710.6 Penetrations and Joints. The space around penetrating items and in joints shall be filled with an approved material to limit the free passage of smoke.

710.7 Ducts and Air Transfer Openings. Air transfer openings in smoke partitions shall be provided with a smoke damper complying with 780 CMR 716.3.2.

Exception. Where the installation of a smoke damper will interfere with the operation of a required smoke control system in accordance with 780 CMR 909.0, approved alternative protection shall be utilized.

780 CMR 711.0 HORIZONTAL ASSEMBLIES

711.1 General. Floor and roof assemblies required to have a fire-resistance rating shall comply with 780 CMR 711.0.

711.2 Materials. The floor and roof assemblies shall be of materials permitted by the building type of construction.

711.3 Fire-resistance Rating. The fire-resistance rating of floor and roof assemblies shall not be less than that required by the building type of construction. Where the floor assembly separates mixed occupancies, the assembly shall have a fire-resistance rating of not less than that required by 780 CMR 302.3.2 based on the occupancies being separated. Where the floor assembly separates a single occupancy into different fire areas, the assembly shall have a fire-resistance rating of not less than that required by 780 CMR 706.3.7. Floor assemblies separating dwelling units in the same building or sleeping units in occupancies in Group R-1, hotel occupancies, R-2 and I-1 shall be a minimum of one-hour fire-resistance-rated construction.

Exception. Dwelling unit and sleeping unit separations in buildings of Type IIB, IIIB, and VB construction shall have fire-resistance ratings of not less than ½ hour in buildings equipped throughout with an automatic sprinkler system in accordance with 780 CMR 903.3.1.1.

711.3.1 Ceiling Panels. Where the weight of lay-in ceiling panels, used as part of fire-resistance-rated floor/ceiling or roof/ceiling assemblies, is not adequate to resist an upward force of 1 lb/ft.2 (48 Pa), wire or other approved devices shall be installed above the panels to prevent vertical displacement under such upward force.

711.3.2 Access Doors. Access doors shall be permitted in ceilings of fire-resistance-rated floor/ceiling and roof/ceiling assemblies provided such doors are tested in accordance with ASTM E 119 as horizontal assemblies and labeled by an approved agency for such purpose.

711.3.3 Unusable Space. In one-hour fire-resistance-rated floor construction, the ceiling membrane is not required to be installed over unusable crawl spaces. In one-hour fire-resistance-rated roof construction, the floor membrane is not required to be installed where unusable attic space occurs above.

711.4 Continuity. Assemblies shall be continuous without openings, penetrations or joints except as permitted by 780 CMR 711.4 and 780 CMR 707.2, 712.4 and 713.0. Skylights and other penetrations through a fire-resistance-rated roof deck are permitted to be unprotected, provided that the structural integrity of the fire-resistance-rated roof construction is maintained. Unprotected skylights shall not be permitted in roof construction required to be fire-resistance rated in accordance with 780 CMR 704.10. The supporting construction shall be protected to afford the required fire-resistance rating of the horizontal assembly supported.

711.5 Penetrations. Penetrations through fire-resistance-rated horizontal assemblies shall comply with 780 CMR 712.

711.6 Joints. Joints made in or between fire-resistance-rated horizontal assemblies shall comply with 780 CMR 713. The void created at the intersection of a floor/ceiling assembly and an exterior curtain wall assembly shall be protected in accordance with 780 CMR 713.4.

711.7 Ducts and Air Transfer Openings. Penetrations by ducts and air transfer openings shall comply with 780 CMR 712.0 and 716.0.

780 CMR 712.0 PENETRATIONS

712.1 Scope. The provisions of 780 CMR 712.0 shall govern the materials and methods of construction used to protect through penetrations and membrane penetrations.

712.2 Installation Details. Where sleeves are used, they shall be securely fastened to the assembly penetrated. The space between the item contained in the sleeve and the sleeve itself and any space between the sleeve and the assembly penetrated shall be protected in accordance with 780 CMR 712.2. Insulation and coverings on or in the penetrating item shall not penetrate the assembly unless the specific material used has been tested as part of the assembly in accordance with 780 CMR 712.2.

712.3 Fire-resistance-rated Walls. Penetrations into or through fire walls, fire barriers, smoke barrier walls, and fire partitions shall comply with 780 CMR 712.3.

712.3.1 Through Penetrations. Through penetrations of fire-resistance-rated walls shall comply with 780 CMR 712.3.1.1 or 712.3.1.2.

Exception. Where the penetrating items are steel, ferrous or copper pipes or steel conduits, the annular space between the penetrating item and the fire-resistance-rated wall shall be permitted to be protected as follows:

1. In concrete or masonry walls where the penetrating item is a maximum six-inch (152 mm) nominal diameter and the opening is a maximum 144 square inches (0.0929 m^2), concrete, grout or mortar shall be permitted where installed the full thickness of the wall or the thickness required to maintain the fire-resistance rating; or
2. The material used to fill the annular space shall prevent the passage of flame and hot gases sufficient to ignite cotton waste when subjected to ASTM E 119 time-temperature fire conditions under a minimum positive pressure differential of 0.01 inch (2.49 Pa) of water at the location of the penetration for the time period equivalent to the fire-resistance rating of the construction penetrated.

712.3.1.1 Fire-resistance-rated Assemblies. Penetrations shall be installed as tested in an approved fire-resistance-rated assembly.

712.3.1.2 Through-penetration Firestop System. Through penetrations shall be protected by an approved penetration firestop system installed as tested in accordance with ASTM E 814 or UL 1479, with a minimum positive pressure differential of 0.01 inch (2.49 Pa) of water and shall have an F rating of not less than the required fire-resistance rating of the wall penetrated.

712.3.2 Membrane Penetrations. Membrane penetrations shall comply with 780 CMR 712.3.1. Where walls and partitions are required to have a minimum one-hour fire-resistance rating, recessed fixtures shall be installed such that the required fire resistance will not be reduced.

Exceptions:

1. Steel electrical boxes that do not exceed 16 square inches (0.0103 m^2) in area provided the total area of such openings does not exceed 100 square inches (0.0645 m^2) for any 100 square feet (9.29 m^2) of wall area. Outlet boxes on opposite sides of the wall shall be separated as shown:
    1.1. By a horizontal distance of not less than 24 inches (610 mm);
    1.2. By a horizontal distance of not less than the depth of the wall cavity where the wall cavity is filled with cellulose loose fill, rockwool or slag mineral wool insulation;
    1.3. By solid fireblocking in accordance with 780 CMR 717.2.1;
    1.4. By protecting both outlet boxes with listed putty pads; or
    1.5. By other listed materials and methods.
2. Membrane penetrations for listed electrical outlet boxes of any material are permitted provided such boxes have been tested for use in fire-resistance-rated assemblies and are installed in accordance with the instructions included in the listing. Outlet boxes on opposite sides of the wall shall be separated as follows:
    2.1. By a horizontal distance of not less than 24 inches (610 mm);
    2.2. By solid fireblocking in accordance with 780 CMR 717.2.1;
    2.3. By protecting both outlet boxes with listed putty pads; or
    2.4. By other listed materials and methods.
3. The annular space created by the penetration of a fire sprinkler provided it is covered by a metal escutcheon plate.

712.3.3 Ducts and Air Transfer Openings. Penetrations of fire-resistance-rated walls by ducts and air transfer openings that are not protected with fire dampers shall comply with 780 CMR 712.3.

712.3.4 Dissimilar Materials. Noncombustible penetrating items shall not connect to combustible items beyond the point of firestopping unless it can be demonstrated that the fire-resistance integrity of the wall is maintained.

712.4 Horizontal Assemblies. Penetrations of a floor, floor/ceiling assembly or the ceiling membrane of a roof/ceiling assembly shall be protected in accordance with 780 CMR 707.0. Penetrations permitted by Exceptions 3 and 4 of 780 CMR 707.2 shall comply with 780 CMR 712.4.1 through 712.4.4.

Exception. Penetrations located within the same room or undivided area as floor openings are not required to have a shaft enclosure in accordance with Exception 1, 2, 5, 7, 8 or 9 in 780 CMR 707.2.

712.4.1 Through Penetrations. Through penetrations of fire-resistance-rated horizontal assemblies shall comply with 780 CMR 712.4.1.1 or 712.4.1.2.

Exceptions:

1. Penetrations by steel, ferrous or copper conduits, pipes, tubes, vents, concrete, or masonry through a single fire-resistance-rated floor assembly where the annular space is protected with materials that prevent the passage of flame and hot gases sufficient to ignite cotton waste when subjected to ASTM E 119 time-temperature fire conditions under a minimum positive pressure differential of 0.01 inch (2.49 Pa) of water at the location of the penetration for the time period equivalent to the fire-resistance rating of the construction penetrated. Penetrating items with a maximum six-inch (152 mm) nominal diameter shall not be limited to the penetration of a single fire-resistance-rated floor assembly provided that the area of the penetration does not exceed 144 square inches (92 900 mm^2) in any 100 square feet (9.3 m^2) of floor area.
2. Penetrations in a single concrete floor by steel, ferrous or copper conduits, pipes, tubes and vents with a maximum six-inch (152 mm) nominal diameter provided concrete, grout or mortar is installed the full thickness of the floor or the thickness required to maintain the fire-resistance rating. The penetrating items with a maximum six-inch (152 mm) nominal diameter shall not be limited to the penetration of a single concrete floor provided that the area of the penetration does not exceed 144 square inches (0.0929 m^2).
3. Electrical outlet boxes of any material are permitted provided that such boxes are tested for use in fire-resistance-rated assemblies and installed in accordance with the tested assembly.

712.4.1.1 Fire-resistance-rated Assemblies. Penetrations shall be installed as tested in an approved fire-resistance-rated assembly.

712.4.1.2 Through-penetration Firestop System. Through penetrations shall be protected by an approved through-penetration firestop system installed and tested in accordance with ASTM E 814 or UL 1479, with a minimum positive pressure differential of 0.01 inch (2.49 Pa) of water. The system shall have an F rating and a T rating of not less than one hour but not less than the required rating of the floor penetrated.

Exception. Floor penetrations contained and located within the cavity of a wall do not require a T rating.

712.4.2 Membrane Penetrations. Penetrations of membranes that are part of a fire-resistance-rated horizontal assembly shall comply with 780 CMR 712.4.1.1 or 712.4.1.2. Where floor/ceiling assemblies are required to have a minimum one-hour fire-resistance rating, recessed fixtures shall be installed such that the required fire resistance will not be reduced.

Exceptions:

1. Membrane penetrations by steel, ferrous or copper conduits, electrical outlet boxes, pipes, tubes, vents, concrete, or masonry-penetrating items where the annular space is protected either in accordance with 780 CMR 712.4.1 or to prevent the free passage of flame and the products of combustion. Such penetrations shall not exceed an aggregate area of 100 square inches (64 500 mm^2) in any 100 square feet (9.3 m^2) of ceiling area in assemblies tested without penetrations.
2. Membrane penetrations by listed electrical outlet boxes of any material are permitted provided such boxes have been tested for use in fire-resistance-rated assemblies and are installed in accordance with the instructions included in the listing.
3. The annular space created by the penetration of a fire sprinkler provided it is covered by a metal escutcheon plate.

712.4.3 Nonfire-resistance-rated Assemblies. Penetrations of horizontal assemblies without a required fire-resistance rating shall meet the requirements of 780 CMR 707.0 or shall comply with 780 CMR 712.4.3.1 through 712.4.3.2.

712.4.3.1 Noncombustible Penetrating Items. Noncombustible penetrating items that connect not more than three stories are permitted provided that the annular space is filled with an approved noncombustible material to resist the free passage of flame and the products of combustion.

712.4.3.2 Penetrating Items. Penetrating items that connect not more than two stories are permitted provided that the annular space is filled with an approved material to resist the free passage of flame and the products of combustion.

712.4.4 Ducts and Air Transfer Openings. Penetrations of horizontal assemblies by ducts and air transfer openings that are not required to have dampers shall comply with 780 CMR 712.4. Ducts and air transfer openings that are protected with dampers shall comply with 780 CMR 716.

712.4.5 Dissimilar Materials. Noncombustible penetrating items shall not connect to combustible materials beyond the point of firestopping unless it can be demonstrated that the fire-resistance integrity of the horizontal assembly is maintained.

712.4.6 Floor Fire Doors. Floor fire doors used to protect openings in fire-resistance-rated floors shall be tested in the horizontal position in accordance with ASTM E 119, and shall achieve a fire-resistance rating not less than the assembly being penetrated. Floor fire doors shall be labeled by an approved agency.

780 CMR 713.0 FIRE-RESISTANT JOINT SYSTEMS

713.1 General. Joints installed in or between fire-resistance-rated walls, floor or floor/ceiling assemblies and roofs or roof/ceiling assemblies shall be protected by an approved fire-resistant joint system designed to resist the passage of fire for a time period not less than the required fire-resistance rating of the wall, floor or roof in or between which it is installed. Fire-resistant joint systems shall be tested in accordance with 780 CMR 713.3. The void created at the intersection of a floor/ceiling assembly and an exterior curtain wall assembly shall be protected in accordance with 780 CMR 713.4.

Exception. Fire-resistant joint systems shall not be required for joints in all of the following locations:

1. Floors within a single dwelling unit.
2 Floors where the joint is protected by a shaft enclosure in accordance with 780 CMR 707.0.
3. Floors within atriums where the space adjacent to the atrium is included in the volume of the atrium for smoke control purposes.
4. Floors within malls.
5. Floors within open parking structures.
6. Mezzanine floors.
7. Walls that are permitted to have unprotected openings.
8. Roofs where openings are permitted.
9. Control joints not exceeding a maximum width of 0.625 inch (15.9 mm) and tested in accordance with ASTM E 119.

713.2 Installation. Fire-resistant joint systems shall be securely installed in or on the joint for its entire length so as not to dislodge, loosen or otherwise impair its ability to accommodate expected building movements and to resist the passage of fire and hot gases.

713.3 Fire Test Criteria. Fire-resistant joint systems shall be tested in accordance with the requirements of either ASTM E 1966 or UL 2079. Nonsymmetrical wall joint systems shall be tested with both faces exposed to the furnace, and the assigned fire-resistance rating shall be the shortest duration obtained from the two tests. When evidence is furnished to show that the wall was tested with the least fire-resistant side exposed to the furnace, subject to acceptance of the building official, the wall need not be subjected to tests from the opposite side.

> **Exception**. For exterior walls with a horizontal fire separation distance greater than five feet (1524 mm), the joint system shall be required to be tested for interior fire exposure only.

713.4 Exterior Curtain Wall/floor Intersection. Where fire- resistance-rated floor or floor/ceiling assemblies are required, voids created at the intersection of the exterior curtain wall assemblies and such floor assemblies shall be sealed with an approved material or system to prevent the interior spread of fire. Such material or systems shall be securely installed and capable of preventing the passage of flame and hot gases sufficient to ignite cotton waste where subjected to ASTM E 119 time-temperature fire conditions under a minimum positive pressure differential of 0.01 inch of water (2.49 Pa) for the time period at least equal to the fire-resistance rating of the floor assembly. Height and fire-resistance requirements for curtain wall spandrels shall comply with 780 CMR 704.9.

780 CMR 714.0 FIRE-RESISTANCE RATING OF STRUCTURAL MEMBERS

714.1 Requirements. The fire-resistance rating of structural members and assemblies shall comply with the requirements for the type of construction and shall not be less than the rating required for the fire-resistance-rated assemblies supported.

> **Exception**. Fire barriers and fire partitions as provided in 780 CMR 706.4 and 708.4, respectively.

714.2 Protection of Structural Members. Protection of columns, girders, trusses, beams, lintels or other structural members that are required to have a fire-resistance rating shall comply with 780 CMR 714.2.

714.2.1 Individual Protection. Columns, girders, trusses, beams, lintels or other structural members that are required to have a fire-resistance rating and that support more than two floors or one floor and roof, or support a load-bearing wall or a nonload-bearing wall more than two stories high, shall be individually protected on all sides for the full length with materials having the required fire-resistance rating. Other structural members required to have a fire-resistance rating shall be protected by individual encasement, by a membrane or ceiling protection as specified in 780 CMR 711.0, or by a combination of both. Columns shall also comply with 780 CMR 714.2.2.

714.2.2 Column Protection above Ceilings. Where columns require a fire-resistance rating, the entire column, including its connections to beams or girders, shall be protected. Where the column extends through a ceiling, fire resistance of the column shall be continuous from the top of the floor through the ceiling space to the top of the column.

714.2.3 Truss Protection. The required thickness and construction of fire-resistance-rated assemblies enclosing trusses shall be based on the results of full-scale tests or combinations of tests on truss components or on approved calculations based on such tests that satisfactorily demonstrate that the assembly has the required fire resistance.

714.2.4 Attachments to Structural Members. The edges of lugs, brackets, rivets and bolt heads attached to structural members shall be permitted to extend to within one inch (25 mm) of the surface of the fire protection.

714.2.5 Reinforcing. Thickness of protection for concrete or masonry reinforcement shall be measured to the outside of the reinforcement except that stirrups and spiral reinforcement ties are permitted to project not more than 0.5-inch (12.7 mm) into the protection.

714.3 Embedments and Enclosures. Pipes, wires, conduits, ducts or other service facilities shall not be embedded in the required fire protective covering of a structural member that is required to be individually encased.

714.4 Impact Protection. Where the fire protective covering of a structural member is subject to impact damage from moving vehicles, the handling of merchandise or other activity, the fire protective covering shall be protected by corner guards or by a substantial jacket of metal or other noncombustible material to a height adequate to provide full protection, but not less than five feet (1524 mm) from the finished floor.

714.5 Exterior Structural Members. Load-bearing structural members located within the exterior walls or on the outside of a building or structure shall be provided with the highest fire-resistance rating as determined in accordance with the following:

1. As required by Table 601 for the type of building element based on the type of construction of the building;
2. As required by Table 601 for exterior bearing walls based on the type of construction; and
3. As required by Table 602 for exterior walls based on the fire separation distance.

714.6 Bottom Flange Protection. Fire protection is not required at the bottom flange of lintels, shelf angles and plates, spanning not more than six feet (1829 mm) whether part of the structural frame or not, and from the bottom flange of lintels, shelf angles and plates not part of the structural frame, regardless of span.

714.7 Seismic Isolation Systems. Fire-resistance ratings for the isolation system shall meet the fire-resistance rating required for the columns, walls, or other structural elements in which the isolation system is installed in accordance with Table 601.

Isolation systems required to have a fire-resistance rating shall be protected with approved materials or construction assemblies designed to provide the same degree of fire resistance as the structural element in which it is installed when tested in accordance with ASTM E 119 (see 780 CMR 703.2).

Such isolation system protection applied to isolator units shall be capable of retarding the transfer of heat to the isolator unit in such a manner that the required gravity load-carrying capacity of the isolator unit will not be impaired after exposure to the standard time-temperature curve fire test prescribed in ASTM E 119 for a duration not less than that required for the fire resistance rating of the structure element in which it is installed.

Such isolation system protection applied to isolator units shall be suitably designed and securely installed so as not to dislodge, loosen, sustain damage, or otherwise impair its ability to accommodate the seismic movements for which the isolator unit is designed and to maintain its integrity for the purpose of providing the required fire-resistance protection.

780 CMR 715.0 OPENING PROTECTIVES

715.1 General. Opening protectives required by other sections of 780 CMR shall comply with the provisions of 780 CMR 715.0.

715.2 Fire-resistance-rated Glazing. Labeled fire-resistance-rated glazing tested as part of a fire-resistance-rated wall assembly in accordance with ASTM E 119 shall not be required to comply with 780 CMR 715.2.

715.3 Fire Door and Shutter Assemblies. Approved fire door and fire shutter assemblies shall be constructed of any material or assembly of component materials that conforms to the test requirements of 780 CMR 715.3.1, 715.3.2 or 715.3.3 and the fire protection rating indicated in Table 715.3. Fire door assemblies and shutters shall be installed in accordance with the provisions of 780 CMR 715.3 and NFPA 80.

Exceptions:

1. Labeled protective assemblies that conform to the requirements of 780CMR 715.3 or UL 10A, UL 14B and UL 14C for tin-clad fire door assemblies.
2. Floor fire doors in accordance with 780 CMR 712.4.6.

TABLE 715.3
FIRE DOOR AND FIRE SHUTTER FIRE PROTECTION RATINGS

TYPE OF ASSEMBLY	REQUIRED ASSEMBLY RATING (hours)	MINIMUM FIRE DOOR AND FIRE SHUTTER ASSEMBLY RATING (hours)
Fire walls and fire barriers having a required fire-resistance rating greater than one hour	4	3
	3	3[a]
	2	1½
	1½	1½
Fire barriers having a required fire-resistance rating of one hour:		
Shaft exit enclosure and exit passageway walls	1	1
Other fire barriers	1	¾
Fire partitions:		
Corridor walls	1	⅓[b]
	0.5	⅓[b]
Other fire partitions	1	¾
Exterior walls	3	1½
	2	1½
	1	¾

a. Two doors, each with a fire protection rating of 1½ hours, installed on opposite sides of the same opening in a fire wall, shall be deemed equivalent in fire protection rating to one three-hour fire door.

b. For testing requirements, see 780 CMR 715.3.3.

715.3.1 Side-hinged or Pivoted Swinging Doors. Side-hinged and pivoted swinging doors shall be tested in accordance with NFPA 252 or UL 10C. After five minutes into the NFPA 252 test, the neutral pressure level in the furnace shall be established at 40 inches (1016 mm) or less above the sill.

715.3.2 Other Types of Doors. Other types of doors, including swinging elevator doors, shall be tested in accordance with NFPA 252 or UL 10B. The pressure in the furnace shall be maintained as nearly equal to the atmospheric pressure as possible. Once established, the pressure shall be maintained during the entire test period.

715.3.3 Door Assemblies in Corridors and Smoke Barriers. Fire door assemblies required to have a minimum fire protection rating of 20 minutes where located in corridor walls or smoke barrier walls having a fire-resistance rating in accordance with Table 715.3 shall be tested in accordance with NFPA 252 or UL 10C without the hose stream test. If a 20-minute fire door assembly contains glazing material, the glazing material in the door itself shall have a minimum fire protection rating of 20 minutes and be exempt from the hose stream test. Glazing material in any other part of the door assembly, including transom lites and sidelites, shall be tested in accordance with NFPA 257, including the hose stream test, in accordance with 780 CMR 715.4. Fire door assemblies shall also meet the requirements for a smoke- and draft-control door assembly tested in accordance with UL 1784 with an artificial bottom seal installed across the full width of the bottom of the door assembly. The air leakage rate of the door assembly shall not exceed 3.0 cfm per square foot (0.01524 m^3/s´m^2) of door opening at 0.10 inch (24.9 Pa) of water for both the ambient temperature and elevated temperature tests. Louvers shall be prohibited.

Exceptions:

1. Viewports that require a hole not larger than one inch (25 mm) in diameter through the door, have at least an 0.25-inch-thick (6.4 mm) glass disc and the holder is of metal that will not melt out where subject to temperatures of 1,700°F (927°C).
2. Corridor door assemblies in occupancies of Group I-2 shall be in accordance with 780 CMR 407.3.1.
3. Unprotected openings shall be permitted for corridors in multitheater complexes where each motion picture auditorium has at least one-half of its required exit or exit access doorways opening directly to the exterior or into an exit passageway.

715.3.4 Doors in Vertical Exit Enclosures and Exit Passageways. Fire door assemblies in vertical exit enclosures and exit passageways shall have a maximum transmitted temperature end point of not more than 450°F (232°C) above ambient at the end of 30 minutes of standard fire test exposure.

Exception. The maximum transmitted temperature end point is not required in buildings equipped throughout with an automatic sprinkler system installed in accordance with 780 CMR 903.3.1.1 or 903.3.1.2.

715.3.4.1 Glazing in Doors. Fire-protection-rated glazing in excess of 100 square inches (0.065 m^2) shall be permitted in fire door assemblies when tested in accordance with NFPA 252 as components of the door assemblies and not as glass lights, and shall have a maximum transmitted temperature end point of 450°F (232°C) in accordance with 780 CMR 715.3.4.

Exception. The maximum transmitted temperature end point is not required in buildings equipped throughout with an automatic sprinkler system installed in accordance with 780 CMR 903.3.1.1 or 903.3.1.2.

715.3.5 Labeled Protective Assemblies. Fire door assemblies shall be labeled by an approved agency. The labels shall comply with NFPA 80, and shall be permanently affixed to the door or frame.

715.3.5.1 Fire Door Labeling Requirements. Fire doors shall be labeled showing the name of the manufacturer, the name of the third-party inspection agency, the fire protection rating and, where required for fire doors in exit enclosures by 780 CMR 715.3.4, the maximum transmitted temperature end point. Smoke and draft control doors complying with UL 1784 shall be labeled as such. Labels shall be approved and permanently affixed. The label shall be applied at the factory or location where fabrication and assembly are performed.

715.3.5.2 Oversized Doors. Oversized fire doors shall bear an oversized fire door label by an approved agency or shall be provided with a certificate of inspection furnished by an approved testing agency. When a certificate of inspection is furnished by an approved testing agency, the certificate shall state that the door conforms to the requirements of design, materials and construction, but has not been subjected to the fire test.

715.3.5.3 Smoke and Draft Control Door Labeling Requirements. Smoke and draft control doors complying with UL 1784 shall be labeled in accordance with 780 CMR 715.3.5.1 and shall show the letter "S" on the fire rating label of the door. This marking shall indicate that the door and frame assembly are in compliance when listed or labeled gasketing is also installed.

715.3.5.4 Fire Door Frame Labeling Requirements. Fire door frames shall be labeled showing the names of the manufacturer and the third-party inspection agency.

715.3.6 Glazing Material. Fire-protection-rated glazing conforming to the opening protection requirements in 780 CMR 715.3 shall be permitted in fire door assemblies.

715.3.6.1 Size Limitations. Wired glass used in fire doors shall comply with Table 715.4.3. Other fire-protection-rated glazing shall comply with the size limitations of NFPA 80.

Exceptions:

1. Fire-protection-rated glazing in fire doors located in fire walls shall be prohibited except that where serving as a horizontal exit, a self-closing swinging door shall be permitted to have a vision panel of not more than 100 square inches (0.065 m^2) without a dimension exceeding ten inches (254 mm).

2. Fire-protection-rated glazing shall not be installed in fire doors having a 1½-hour fire protection rating intended for installation in fire barriers, unless the glazing is not more than 100 square inches (0.065 m^2) in area.

715.3.6.2 Exit and Elevator Protectives. Approved fire-protection-rated glazing used in fire doors in elevator and stairway shaft enclosures shall be so located as to furnish clear vision of the passageway or approach to the elevator or stairway.

715.3.6.3 Labeling. Fire-protection-rated glazing shall bear a label or other identification showing the name of the manufacturer, the test standard and the fire protection rating. Such label or other identification shall be issued by an approved agency and shall be permanently affixed.

715.3.6.4 Safety Glazing. Fire-protection-rated glazing installed in fire doors or fire window assemblies in areas subject to human impact in hazardous locations shall comply with 780 CMR 24.0.

715.3.7 Door Closing. Fire doors shall be self-closing or automatic-closing in accordance with 780 CMR 715.3.

Exception. Fire doors located in common walls separating sleeping units in Group R-1 shall be permitted without automatic-closing or self-closing devices.

715.3.7.1 Latch Required. Unless otherwise specifically permitted, single fire doors and both leaves of pairs of side-hinged swinging fire doors shall be provided with an active latch bolt that will secure the door when it is closed.

715.3.7.2 Automatic-closing Fire Door Assemblies. Automatic-closing fire door assemblies shall be self-closing in accordance with NFPA 80.

715.3.7.3 Smoke-activated Doors. Automatic-closing fire doors installed in the following locations shall be automatic-closing by the actuation of smoke detectors installed in accordance with 780 CMR 907.10 or by loss of power to the smoke detector or hold-open device. Fire doors that are automatic-closing by smoke detection shall not have more than a ten-second delay before the door starts to close after the smoke detector is actuated.

1. Doors installed across a corridor.
2. Doors that protect openings in horizontal exits, exits or exit access corridors required to be of fire-resistance-rated construction.
3. Doors that protect openings in walls required to be fire-resistance rated by Table 302.1.1.
4. Doors installed in smoke barriers in accordance with 780 CMR 709.5.
5. Doors installed in fire partitions in accordance with 780 CMR 708.6.
6. Doors installed in a fire wall in accordance with 780 CMR 705.8.

715.3.7.4 Doors in Pedestrian Ways. Vertical sliding or vertical rolling steel fire doors in openings through which pedestrians travel shall be heat activated or activated by smoke detectors with alarm verification.

715.3.8 Swinging Fire Shutters. Where fire shutters of the swinging type are installed in exterior openings, not less than one row in every three vertical rows shall be arranged to be readily opened from the outside, and shall be identified by distinguishing marks or letters not less than six inches (152 mm) high.

715.3.9 Rolling Fire Shutters. Where fire shutters of the rolling type are installed, such shutters shall include approved automatic-closing devices.

715.4 Fire-protection Rated Glazing. Glazing in fire window assemblies shall be fire protection rated in accordance with 780 CMR 715.4 and Table 715.4. Glazing in fire doors shall comply with 780 CMR 715.3.6. Fire-protection-rated glazing installed as an opening protective in fire partitions, smoke barriers and fire barriers shall be tested in accordance with and shall meet the acceptance criteria of NFPA 257 for a fire protection rating of 45 minutes. Fire-protection-rated glazing shall also comply with NFPA 80. Fire-protection-rated glazing required in accordance with 780 CMR 704.12 for exterior wall opening protection shall be tested in accordance with and shall meet the acceptance criteria of NFPA 257 for a fire protection rating as required in 780 CMR 715.4.8.

Exceptions:

1. Wired glass in accordance with 780 CMR 715.4.3.
2. Fire-protection-rated glazing in 0.5-hour fire-resistance-rated partitions is permitted to have an 0.33-hour fire protection rating.

TABLE 715.4
FIRE WINDOW ASSEMBLY FIRE PROTECTION RATINGS

TYPE OF ASSEMBLY	REQUIRED ASSEMBLY RATING (hours)	MINIMUM FIRE WINDOW ASSEMBLY RATING (hours)
Interior walls:		
Fire walls	All	NP[a]
Fire barriers and fire partitions	>1	NP[a]
	1	¾
Smoke barriers	1	¾
Exterior walls	>1	1½
	1	¾
Party walls	All	NP[a]

a. Not permitted except as specified in 780 CMR 715.2.

715.4.1 Testing under Positive Pressure. NFPA 257 shall evaluate fire-protection-rated glazing under positive pressure. Within the first ten minutes of a test, the pressure in the furnace shall be adjusted so at least two-thirds of the test specimen is above the neutral pressure plane, and the neutral pressure plane shall be maintained at that height for the balance of the test.

715.4.2 Nonsymmetrical Glazing Systems. Nonsymmetrical fire-protection-rated glazing systems in fire partitions, fire barriers or in exterior walls with a fire separation of five feet (1524 mm) or less pursuant to 780 CMR 704 shall be tested with both faces exposed to the furnace, and the assigned fire protection rating shall be the shortest duration obtained from the two tests conducted in compliance with NFPA 257.

715.4.3 Wired Glass. Steel window frame assemblies of 0.125-inch (3.2 mm) minimum solid section or of not less than nominal 0.048-inch-thick (1.2 mm) formed sheet steel members fabricated by pressing, mitering, riveting, interlocking or welding and having provision for glazing with ¼-inch (6.4 mm) wired glass where securely installed in the building construction and glazed with ¼-inch (6.4 mm) labeled wired glass shall be deemed to meet the requirements for a ¾-hour fire window assembly. Wired glass panels shall conform to the size limitations set forth in Table 715.4.3.

TABLE 715.4.3
LIMITING SIZES OF WIRED GLASS PANELS

OPENING FIRE PROTECTION RATING	MAXIMUM AREA (square inches)	MAXIMUM HEIGHT (inches)	MAXIMUM WIDTH (inches)
3 hours	0	0	0
1½-hour doors in exterior walls	0	0	0
1 and 1½ hours	100	33	10
¾ hour	1296	54	54
20 minutes	Not Limited	Not Limited	Not Limited
Fire window assemblies	1 ,296	54	54

For SI: 1 inch = 25.4 mm, 1 square inch = 645.2 mm^2

715.4.4 Nonwired Glass. Glazing other than wired glass in fire window assemblies shall be fire-protection-rated glazing installed in accordance with and complying with the size limitations set forth in NFPA 80.

715.4.5 Installation. Fire-protection-rated glazing shall be in the fixed position or be automatic-closing and shall be installed in approved frames.

715.4.6 Window Mullions. Metal mullions that exceed a nominal height of 12 feet (3658 mm) shall be protected with materials to afford the same fire-resistance rating as required for the wall construction in which the protective is located.

715.4.7 Interior Fire Window Assemblies. Fire-protection-rated glazing used in fire window assemblies located in fire partitions and fire barriers shall be limited to use in assemblies with a maximum fire-resistance rating of one hour in accordance with 780 CMR 715.4.7.

715.4.7.1 Where Permitted. Fire-protection-rated glazing shall be limited to fire partitions designed in accordance with 780 CMR 708 and fire barriers utilized in the applications set forth in 780 CMR 706.3.5 and 706.3.6 where the fire-resistance rating does not exceed one hour.

715.4.7.2 Size Limitations. The total area of windows shall not exceed 25% of the area of a common wall with any room.

715.4.8 Exterior Fire Window Assemblies. Exterior openings, other than doors, required to be protected by 780 CMR 704.12, where located in a wall required by Table 602 to have a fire-resistance rating of greater than one hour, shall be protected with an assembly having a fire protection rating of not less than 1½ hours. Exterior openings required to be protected by 780 CMR 704.8, where located in a wall required by Table 602 to have a fire-resistance rating of one hour, shall be protected with an assembly having a fire protection rating of not less than ¾ hour. Exterior openings required to be protected by 780 CMR 704.9 or 704.10 shall be protected with an assembly having a fire protection rating of not less than ¾ hour. Openings in nonfire-resistance-rated exterior wall assemblies that require protection in accordance with 780 CMR 704.8, 704.9 or 704.10 shall have a fire protection rating of not less than ¾ hour.

715.4.9 Labeling Requirements. Fire-protection-rated glazing shall bear a label or other identification showing the name of the manufacturer, the test standard, and the fire protection rating. Such label or identification shall be issued by an approved agency and shall be permanently affixed.

780 CMR 716.0 DUCTS AND AIR TRANSFER OPENINGS

716.1 General. The provisions of 780 CMR 716.0 shall govern the protection of ducts and air transfer openings in fire-resistance-rated assemblies.

716.1.1 Ducts and Air Transfer Openings Without Dampers. Ducts and air transfer openings that penetrate fire-resistance-rated assemblies and are not required by 780 CMR 716.1 to have dampers shall comply with the requirements of 780 CMR 712.0.

716.2 Installation. Fire dampers, smoke dampers, combination fire/smoke dampers and ceiling dampers located within air distribution and smoke control systems shall be installed in accordance with the requirements of 780CMR 716.2, the manufacturer's installation instructions and listing.

716.2.1 Smoke Control System. Where the installation of a fire damper will interfere with the operation of a required smoke control system in accordance with 780 CMR 909.0, approved alternative protection shall be utilized.

716.2.2 Hazardous Exhaust Ducts. Fire dampers for hazardous exhaust duct systems shall comply with the *International Mechanical Code*.

716.3 Damper Testing and Ratings. Dampers shall be listed and bear the label of an approved testing agency indicating compliance with the standards in 780 CMR 716.3. Fire dampers shall comply with the requirements of UL 555. Only fire dampers labeled for use in dynamic systems shall be installed in heating, ventilation and air-conditioning systems designed to operate with fans on during a fire. Smoke dampers shall comply with the requirements of UL 555S. Combination fire/smoke dampers shall comply with the requirements of both UL 555 and UL 555S. Ceiling radiation dampers shall comply with the requirements of UL 555C.

716.3.1 Fire Protection Rating. Fire dampers shall have the minimum fire protection rating specified in Table 716.3.1 for the type of penetration.

TABLE 716.3.1
FIRE DAMPER RATING

TYPE OF PENETRATION	MINIMUM DAMPER RATING (hour)
Less than three-hour fire-resistance-rated assemblies	1.5
Three-hour or greater fire-resistance-rated assemblies	3

716.3.1.1 Fire Damper Actuating Device. The fire damper actuating device shall meet one of the following requirements:

1. The operating temperature shall be approximately 50°F (10°C) above the normal temperature within the duct system, but not less than 160°F (71°C).
2. The operating temperature shall be not more than 286°F (141°C) where located in a smoke control system complying with 780 CMR 909.0.
3. Where a combination fire/smoke damper is located in a smoke control system complying with 780 CMR 909.0, the operating temperature rating shall be approximately 50°F (10°C) above the maximum smoke control system designed operating temperature, or a maximum temperature of 350°F (177°C). The temperature shall not exceed the UL 555S degradation test temperature rating for a combination fire/smoke damper.

716.3.2 Smoke Damper Ratings. Smoke damper leakage ratings shall not be less than Class II. Elevated temperature ratings shall not be less than 250°F (121°C).

716.3.2.1 Smoke Damper Actuation Methods. The smoke damper shall close upon actuation of a listed smoke detector or detectors installed in accordance with 780 CMR 907.10 and one of the following methods, as applicable:

1. Where a damper is installed within a duct, a smoke detector shall be installed in the duct within five feet (1524 mm) of the damper with no air outlets or inlets between the detector and the damper. The detector shall be listed for the air velocity, temperature and humidity anticipated at the point where it is installed. Other than in mechanical smoke control systems, dampers shall be closed upon fan shutdown where local smoke detectors require a minimum velocity to operate.
2. Where a damper is installed above smoke barrier doors in a smoke barrier, a spot-type detector listed for releasing service shall be installed on either side of the smoke barrier door opening.
3. Where a damper is installed within an unducted opening in a wall, a spot-type detector listed for releasing service shall be installed within five feet (1524 mm) horizontally of the damper.
4. Where a damper is installed in a corridor wall, the damper shall be permitted to be controlled by a smoke detection system installed in the corridor.
5. Where a total-coverage smoke detector system is provided within areas served by a heating, ventilation and air-conditioning (HVAC) system, dampers shall be permitted to be controlled by the smoke detection system.

716.4 Access and Identification. Fire and smoke dampers shall be provided with an approved means of access, large enough to permit inspection and maintenance of the damper and its operating parts. The access shall not affect the integrity of fire-resistance-rated assemblies. The access openings shall not reduce the fire-resistance rating of the assembly. Access points shall be permanently identified on the exterior by a label having letters not less than 0.5 inch (12.7 mm) in height reading: SMOKE DAMPER or FIRE DAMPER. Access doors in ducts shall be tight fitting and suitable for the required duct construction.

716.5 Where Required. Fire dampers, smoke dampers, combination fire/smoke dampers and ceiling radiation dampers shall be provided at the locations prescribed in 780 CMR 716.5. Where an assembly is required to have both fire dampers and smoke dampers, combination fire/smoke dampers or a fire damper and a smoke damper shall be required.

716.5.1 Fire Walls. Ducts and air transfer openings permitted in fire walls in accordance with 780 CMR 705.11 shall be protected with approved fire dampers installed in accordance with their listing.

716.5.2 Fire Barriers. Ducts and air transfer openings in fire barriers shall be protected with approved fire dampers installed in accordance with their listing.

Exception: Fire dampers are not required at penetrations of fire barriers where any of the following apply:

1. Penetrations are tested in accordance with ASTM E 119 as part of the fire-resistance-rated assembly.
2. Ducts are used as part of an approved smoke control system in accordance with 780 CMR 909.
3. Such walls are penetrated by ducted HVAC systems, have a required fire-resistance rating of one hour or less, are in areas of other than Group H and are in buildings equipped throughout with an automatic sprinkler system in accordance with 780 CMR 903.3.1.1 or 903.3.1.2. For the purposes of this exception, a ducted HVAC system shall be a duct system for conveying supply, return or exhaust air as part of the structure's HVAC system. Such a duct system shall be constructed of sheet steel not less than 26 gage thickness and shall be continuous from the air-handling appliance or equipment to the air outlet and inlet terminals.

716.5.3 Shaft Enclosures. Ducts and air transfer openings shall not penetrate a shaft serving as an exit enclosure except as permitted by 780 CMR 1019.1.2.

716.5.3.1 Penetrations of Shaft Enclosures. Shaft enclosures that are permitted to be penetrated by ducts and air transfer openings shall be protected with approved fire and smoke dampers installed in accordance with their listing.

Exceptions:

1. Fire dampers are not required at penetrations of shafts where:
   - 1.1. Steel exhaust subducts are extended at least 22 inches (559 mm) vertically in exhaust shafts, provided there is a continuous airflow upward to the outside;
   - 1.2. Penetrations are tested in accordance with ASTM E 119 as part of the rated assembly;
   - 1.3. Ducts are used as part of an approved smoke control system designed and installed in accordance with 780 CMR 909, and where the fire damper will interfere with the operation of the smoke control system; or
   - 1.4. The penetrations are in parking garage exhaust or supply shafts that are separated from other building shafts by not less than two-hour fire-resistance-rated construction.
2. In Group B occupancies, equipped throughout with an automatic sprinkler system in accordance with 780 CMR 903.3.1.1, smoke dampers are not required at penetrations of shafts where:
   - 2.1. Bathroom and toilet room exhaust openings with steel exhaust subducts, having a wall thickness of at least 0.019 inches (0.48 mm) that extend at least 22 inches (559 mm) vertically and the exhaust fan at the upper terminus, powered continuously in accordance with the provisions of 780 CMR 909.11, maintains airflow upward to the outside; or
   - 2.2. Ducts are used as part of an approved smoke control system, designed and installed in accordance with 780 CMR 909, and where the smoke damper will interfere with the operation of the smoke control system.
3. Smoke dampers are not required at penetration of exhaust or supply shafts in parking garages that are separated from other building shafts by not less than two-hour fire-resistance-rated construction.

716.5.4 Fire Partitions. Duct penetrations in fire partitions shall be protected with approved fire dampers installed in accordance with their listing.

Exceptions: In occupancies other than Group H, fire dampers are not required where any of the following apply:

1. The partitions are tenant separation and corridor walls in buildings equipped throughout with an automatic sprinkler system in accordance with 780 CMR 903.3.1.1 or 903.3.1.2 and the duct is protected as a through penetration in accordance with 780 CMR 712.0.
2. The duct system is constructed of approved materials in accordance with the *International Mechanical Code* and the duct penetrating the wall meets all of the following minimum requirements:
   2.1. The duct shall not exceed 100 square inches (0.06 m^2).
   2.2. The duct shall be constructed of steel a minimum of 0.0217 inch (0.55 mm) in thickness.
   2.3. The duct shall not have openings that communicate the corridor with adjacent spaces or rooms.
   2.4. The duct shall be installed above a ceiling.
   2.5. The duct shall not terminate at a wall register in the fire-resistance-rated wall.
   2.6. A minimum 12-inch-long (0.30 m) by 0.060-inch-thick (1.52 mm) steel sleeve shall be centered in each duct opening. The sleeve shall be secured to both sides of the wall and all four sides of the sleeve with minimum 1½-inch by 1½-inch by 0.060-inch (0.038 m by 0.038 m by 1.52 mm) steel retaining angles. The retaining angles shall be secured to the sleeve and the wall with No. 10 (M5) screws. The annular space between the steel sleeve and wall opening shall be filled with rock (mineral) wool batting on all sides.

716.5.4.1 Corridors. A listed smoke damper designed to resist the passage of smoke shall be provided at each point a duct or air transfer opening penetrates a corridor enclosure required to have smoke and draft control doors in accordance with 780 CMR 715.3.3.

Exceptions:

1. Smoke dampers are not required where the building is equipped throughout with an approved smoke control system in accordance with 780 CMR 909.0, and smoke dampers are not necessary for the operation and control of the system.
2. Smoke dampers are not required in corridor penetrations where the duct is constructed of steel not less than 0.019-inch (0.48 mm) in thickness and there are no openings serving the corridor.

716.5.5 Smoke Barriers. A listed smoke damper designed to resist the passage of smoke shall be provided at each point a duct or air transfer opening penetrates a smoke barrier. Smoke dampers and smoke damper actuation methods shall comply with 780 CMR 716.3.2.1.

Exception. Smoke dampers are not required where the openings in ducts are limited to a single smoke compartment and the ducts are constructed of steel.

716.6 Horizontal Assemblies. Penetrations by ducts and air transfer openings of a floor, floor/ceiling assembly or the ceiling membrane of a roof/ceiling assembly shall be protected by a shaft enclosure that complies with 780 CMR 707.0 or shall comply with 780 CMR 716.6.

716.6.1 Through Penetrations. In occupancies other than Groups I-2 and I-3, a duct and air transfer opening system constructed of approved materials in accordance with the *International Mechanical Code* that penetrates a fire-resistance-rated floor/ceiling assembly that connects not more than two stories is permitted without shaft enclosure protection provided a fire damper is installed at the floor line.

Exception. A duct is permitted to penetrate three floors or less without a fire damper at each floor provided it meets all of the following requirements.

1. The duct shall be contained and located within the cavity of a wall and shall be constructed of steel not less than 0.019 inch (0.48 mm) (26 gage) in thickness.
2. The duct shall open into only one dwelling unit or sleeping unit and the duct system shall be continuous from the unit to the exterior of the building.
3. The duct shall not exceed four-inch (102 mm) nominal diameter and the total area of such ducts shall not exceed 100 square inches (0.065 m^2) in any 100 square feet (9.3 m^2) of floor area.
4. The annular space around the duct is protected with materials that prevent the passage of flame and hot gases sufficient to ignite cotton waste where subjected to ASTM E 119 time-temperature conditions under a minimum positive pressure differential of 0.01 inch (2.49 Pa) of water at the location of the penetration for the time period equivalent to the fire-resistance rating of the construction penetrated.
5. Grille openings located in a ceiling of a fire-resistance-rated floor/ceiling or roof/ceiling assembly shall be protected with a ceiling radiation damper in accordance with 780 CMR 716.6.2.

716.6.2 Membrane Penetrations. Where duct systems constructed of approved materials in accordance with the *International Mechanical Code* penetrate a ceiling of a fire-resistance-rated floor/ceiling or roof/ceiling assembly, shaft enclosure protection is not required provided an approved ceiling radiation damper is installed at the ceiling line. Where a duct is not attached to a diffuser that penetrates a ceiling of a fire-resistance-rated floor/ceiling or roof/ceiling assembly, shaft enclosure protection is not required provided an approved ceiling radiation damper is installed at the ceiling line. Ceiling radiation dampers shall be tested in accordance with UL 555C and constructed in accordance with the details listed in a fire-resistance-rated assembly or shall be labeled to function as a heat barrier for air-handling outlet/inlet penetrations in the ceiling of a fire-resistance-rated assembly. Ceiling radiation dampers shall not be required where ASTM E 119 fire tests have shown that ceiling radiation dampers are not necessary in order to maintain the fire-resistance rating of the assembly. Ceiling radiation dampers shall not be required where exhaust duct penetrations are protected in accordance with 780 CMR 712.4.2, where exhaust ducts are located within the cavity of a wall, and where exhaust ducts do not pass through another dwelling unit or tenant space.

716.6.3 Nonfire-resistance-rated Assemblies. Duct systems constructed of approved materials in accordance with the *International Mechanical Code* that penetrate nonfire-resistance-rated floor assemblies and that connect not more than two stories are permitted without shaft enclosure protection provided that the annular space between the assembly and the penetrating duct is filled with an approved noncombustible material to resist the free passage of flame and the products of combustion. Duct systems constructed of approved materials in accordance with the *International Mechanical Code* that penetrate nonfire-resistance-rated floor assemblies and that connect not more than three stories are permitted without shaft enclosure protection provided that the annular space between the assembly and the penetrating duct is filled with an approved noncombustible material to resist the free passage of flame and the products of combustion, and a fire damper is installed at each floor line.

Exception. Fire dampers are not required in ducts within individual residential dwelling units.

716.7 Flexible Ducts and Air Connectors. Flexible ducts and air connectors shall not pass through any fire-resistance-rated assembly. Flexible air connectors shall not pass through any wall, floor or ceiling.

780 CMR 717.0 CONCEALED SPACES

717.1 General. Fireblocking and draftstopping shall be installed in combustible concealed locations in accordance with 780 CMR 717.0. Fireblocking shall comply with 780 CMR 717.2. Draftstopping in floor/ceiling spaces and attic spaces shall comply with 780 CMR 717.3 and 717.4, respectively. The permitted use of combustible materials in concealed spaces of noncombustible buildings shall be limited to the applications indicated in 780 CMR 717.5.

717.2 Fireblocking. In combustible construction, fireblocking shall be installed to cut off concealed draft openings (both vertical and horizontal) and shall form an effective barrier between floors, between a top story and a roof or attic space. Fireblocking shall be installed in the locations specified in 780 CMR 717.2.2 through 717.2.7.

717.2.1 Fireblocking Materials. Fireblocking shall consist of two-inch (51 mm) nominal lumber or two thicknesses of one-inch (25 mm) nominal lumber with broken lap joints or one thickness of 0.719-inch (18.3 mm) wood structural panel with joints backed by 0.719-inch (18.3 mm) wood structural panel or one thickness of 0.75-inch (19 mm) particleboard with joints backed by 0.75-inch (19 mm) particleboard. Gypsum board, cement fiber board, batts or blankets of mineral wool or glass fiber or other approved materials installed in such a manner as to be securely retained in place shall be permitted as an acceptable fireblock. Batts or blankets of mineral or glass fiber or other approved nonrigid materials shall be permitted for compliance with the ten-foot (3048 mm) horizontal fireblocking in walls constructed using parallel rows of studs or staggered studs. Loose-fill insulation material shall not be used as a fireblock unless specifically tested in the form and manner intended for use to demonstrate its ability to remain in place and to retard the spread of fire and hot gases. The integrity of fireblocks shall be maintained.

717.2.1.1 Double Stud Walls. Batts or blankets of mineral or glass fiber or other approved nonrigid materials shall be allowed as fireblocking in walls constructed using parallel rows of studs or staggered studs.

717.2.2 Concealed Wall Spaces. Fireblocking shall be provided in concealed spaces of stud walls and partitions, including furred spaces, and parallel rows of studs or staggered studs, as follows:

a. Vertically at the ceiling and floor levels.
b. Horizontally at intervals not exceeding ten feet (3048 mm).

717.2.3 Connections Between Horizontal and Vertical Spaces. Fireblocking shall be provided at interconnections between concealed vertical stud wall or partition spaces and concealed horizontal spaces created by an assembly of floor joists or trusses, and between concealed vertical and horizontal spaces such as occur at soffits, drop ceilings, cove ceilings and similar locations.

717.2.4 Stairways. Fireblocking shall be provided in concealed spaces between stair stringers at the top and bottom of the run. Enclosed spaces under stairs shall also comply with 780 CMR 1019.1.5.

717.2.5 Ceiling and Floor Openings. Where annular space protection is provided in accordance with Exception 6 of 780 CMR 707.2, Exception one of 780 CMR 712.4.2, or 780 CMR 712.4.3, fireblocking shall be installed at openings around vents, pipes, ducts, chimneys and fireplaces at ceiling and floor levels, with an approved material to resist the free passage of flame and the products of combustion. Factory-built chimneys and fireplaces shall be fireblocked in accordance with UL 103 and UL 127.

717.2.6 Architectural Trim. Fireblocking shall be installed within concealed spaces of exterior wall finish and other exterior architectural elements where permitted to be of combustible construction as specified in 780 CMR 1406 or where erected with combustible frames, at maximum intervals of 20 feet (6096 mm). If noncontinuous, such elements shall have closed ends, with at least four inches (102 mm) of separation between sections.

Exceptions:

1. Fireblocking of cornices is not required in single-family dwellings, as applicable in 780 CMR 101.2. Fireblocking of cornices of a two-family dwelling as applicable in 780 CMR 101.2 is required only at the line of dwelling unit separation.
2. Fireblocking shall not be required where installed on noncombustible framing and the face of the exterior wall finish exposed to the concealed space is covered by one of the following materials:
   - 2.1. Aluminum having a minimum thickness of 0.019 inch (0.5 mm).
   - 2.2. Corrosion-resistant steel having a base metal thickness not less than 0.016 inch (0.4 mm) at any point.
   - 2.3. Other approved noncombustible materials.

717.2.7 Concealed Sleeper Spaces. Where wood sleepers are used for laying wood flooring on masonry or concrete fire-resistance-rated floors, the space between the floor slab and the underside of the wood flooring shall be filled with an approved material to resist the free passage of flame and products of combustion or fireblocked in such a manner that there will be no open spaces under the flooring that will exceed 100 square feet (9.3 m^2) in area and such space shall be filled solidly under permanent partitions so that there is no communication under the flooring between adjoining rooms.

Exceptions:

1. Fireblocking is not required for slab-on-grade floors in gymnasiums.
2. Fireblocking is required only at the juncture of each alternate lane and at the ends of each lane in a bowling facility.

717.3 Draftstopping in Floors. In combustible construction, draftstopping shall be installed to subdivide floor/ceiling assemblies in the locations prescribed in 780 CMR 717.3.2 through 717.3.3.

717.3.1 Draftstopping Materials. Draftstopping materials shall not be less than 0.5-inch (12.7 mm) gypsum board, 0.375-inch (9.5 mm) wood structural panel, 0.375-inch (9.5 mm) particle-board or other approved materials adequately supported. The integrity of draftstops shall be maintained.

717.3.2 Groups R-1, R-2, R-3 and R-4. Draftstopping shall be provided in floor/ceiling spaces in Group R-1 buildings, in Group R-2 buildings as applicable in 780 CMR 101.2 with three or more dwelling units, in Group R-3 buildings as applicable in 780 CMR 101.2 with two dwelling units and in Group R-4 buildings. Draftstopping shall be located above and in line with the dwelling unit and sleeping unit separations.

Exceptions:

1. Draftstopping is not required in buildings equipped throughout with an automatic sprinkler system in accordance with 780 CMR 903.3.1.1.
2. Draftstopping is not required in buildings equipped throughout with an automatic sprinkler system in accordance with 780 CMR 903.3.1.2, provided that automatic sprinklers are also installed in the combustible concealed spaces.

717.3.3 Other Groups. In other groups, draftstopping shall be installed so that horizontal floor areas do not exceed 1,000 square feet (93 m^2).

Exception. Draftstopping is not required in buildings equipped throughout with an automatic sprinkler system in accordance with 780 CMR 903.3.1.1.

717.4 Draftstopping in Attics. In combustible construction, draftstopping shall be installed to subdivide attic spaces and concealed roof spaces in the locations prescribed in 780 CMR 717.4.2 and 717.4.3. Ventilation of concealed roof spaces shall be maintained in accordance with 780 CMR 1203.2.

717.4.1 Draftstopping Materials. Materials utilized for draftstopping of attic spaces shall comply with 780 CMR 717.3.1.

717.4.1.1 Openings. Openings in the partitions shall be protected by self-closing doors with automatic latches constructed as required for the partitions.

717.4.2 Groups R-1 and R-2. Draftstopping shall be provided in attics, mansards, overhangs or other concealed roof spaces of Group R-2 buildings with three or more dwelling units and in all Group R-1 buildings. Draftstopping shall be installed above, and in line with, sleeping unit and dwelling unit separation walls that do not extend to the underside of the roof sheathing above.

Exceptions:

1. Where corridor walls provide a sleeping unit or dwelling unit separation, draftstopping shall only be required above one of the corridor walls.
2. Draftstopping is not required in buildings equipped throughout with an automatic sprinkler system in accordance with 780 CMR 903.3.1.1.
3. In occupancies in Group R-2 that do not exceed four stories in height, the attic space shall be subdivided by draftstops into areas not exceeding 3,000 square feet (279 m^2) or above every two dwelling units, whichever is smaller.
4. Draftstopping is not required in buildings equipped throughout with an automatic sprinkler system in accordance with 780 CMR 903.3.1.2, provided that automatic sprinklers are also installed in the combustible concealed spaces.

717.4.3 Other Groups. Draftstopping shall be installed in attics and concealed roof spaces, such that any horizontal area does not exceed 3,000 square feet (279 m^2).

Exception. Draftstopping is not required in buildings equipped throughout with an automatic sprinkler system in accordance with 780 CMR 903.3.1.1.

717.5 Combustibles in Concealed Spaces in Type I or II Construction. Combustibles shall not be permitted in concealed spaces of buildings of Type I or II construction.

Exceptions:

1. Combustible materials in accordance with 780 CMR 603.0.
2. Combustible materials complying with the *International Mechanical Code*, Section 602.
3. Class A interior finish materials.
4. Combustible piping within partitions or enclosed shafts installed in accordance with the provisions of 780 CMR. Combustible piping shall be permitted within concealed ceiling spaces where installed in accordance with the *International Mechanical Code* and the *International Plumbing Code*.

780 CMR 718.0 FIRE-RESISTANCE REQUIREMENTS FOR PLASTER

718.1 Thickness of Plaster. The minimum thickness of gypsum plaster or portland cement plaster used in a fire-resistance-rated system shall be determined by the prescribed fire tests. The plaster thickness shall be measured from the face of the lath where applied to gypsum lath or metal lath.

718.2 Plaster Equivalents. For fire-resistance purposes, 0.5 inch (12.7 mm) of unsanded gypsum plaster shall be deemed equivalent to 0.75 inch (19.1 mm) of one-to-three gypsum sand plaster or one inch (25 mm) of portland cement sand plaster.

718.3 Noncombustible Furring. In buildings of Type I and II construction, plaster shall be applied directly on concrete or masonry or on approved noncombustible plastering base and furring.

718.4 Double Reinforcement. Plaster protection more than one inch (25 mm) in thickness shall be reinforced with an additional layer of approved lath embedded at least 0.75 inch (19.1 mm) from the outer surface and fixed securely in place.

Exception. Solid plaster partitions or where otherwise determined by fire tests.

718.5 Plaster Alternatives for Concrete. In reinforced concrete construction, gypsum plaster or portland cement plaster is permitted to be substituted for 0.5 inch (12.7 mm) of the required poured concrete protection, except that a minimum thickness of 0.375 inch (9.5 mm) of poured concrete shall be provided in reinforced concrete floors and one inch (25 mm) in reinforced concrete columns in addition to the plaster finish. The concrete base shall be prepared in accordance with 780 CMR 2510.7.

780 CMR 719.0 THERMAL- AND SOUND-INSULATING MATERIALS

719.1 General. Insulating materials, including facings such as vapor retarders and vapor-permeable membranes, similar coverings, and all layers of single and multilayer reflective foil insulations, shall comply with the requirements of 780 CMR 719.0. Where a flame spread index or a smoke-developed index is specified in 780 CMR 719.0, such index shall be determined in accordance with ASTM E 84. Any material that is subject to an increase in flame spread index or smoke-developed index beyond the limits herein established through the effects of age, moisture, or other atmospheric conditions shall not be permitted.

Exceptions:

1. Fiberboard insulation shall comply with 780 CMR 23.00.
2. Foam plastic insulation shall comply with 780 CMR 26.00.

3. Duct and pipe insulation and duct and pipe coverings and linings in plenums shall comply with the *International Mechanical Code*.

719.2 Concealed Installation. Insulating materials, where concealed as installed in buildings of any type of construction, shall have a flame spread index of not more than 25 and a smoke-developed index of not more than 450.

Exception. Cellulose loose-fill insulation that is not spray applied, complying with the requirements of 780 CMR 719.6, shall only be required to meet the smoke-developed index of not more than 450.

719.2.1 Facings. Where such materials are installed in concealed spaces in buildings of Type III, IV or V construction, the flame spread and smoke-developed limitations do not apply to facings, coverings, and layers of reflective foil insulation that are installed behind and in substantial contact with the unexposed surface of the ceiling, wall or floor finish.

719.3 Exposed Installation. Insulating materials, where exposed as installed in buildings of any type of construction, shall have a flame spread index of not more than 25 and a smoke-developed index of not more than 450.

Exception. Cellulose loose-fill insulation that is not spray applied complying with the requirements of 780 CMR 719.6 shall only be required to meet the smoke-developed index of not more than 450.

719.3.1 Attic Floors. Exposed insulation materials installed on attic floors shall have a critical radiant flux of not less than 0.12 watt per square centimeter when tested in accordance with ASTM E 970.

719.4 Loose-fill Insulation. Loose-fill insulation materials that cannot be mounted in the ASTM E 84 apparatus without a screen or artificial supports shall comply with the flame spread and smoke-developed limits of 780 CMR 719.2 and 719.3 when tested in accordance with CAN/ULC S102.2.

Exception. Cellulose loose-fill insulation shall not be required to comply with this test method, provided such insulation complies with the requirements of 780 CMR 719.6.

719.5 Roof Insulation. The use of combustible roof insulation not complying with 780 CMR 719.2 and 719.3 shall be permitted in any type of construction provided it is covered with approved roof coverings directly applied thereto.

719.6 Cellulose Loose-fill Insulation. Cellulose loose-fill insulation shall comply with CPSC 16 CFR, Part 1209 and CPSC 16 CFR, Part 1404. Each package of such insulating material shall be clearly labeled in accordance with CPSC 16 CFR, Part 1209 and CPSC 16 CFR, Part 1404.

719.7 Insulation and Covering on Pipe and Tubing. Insulation and covering on pipe and tubing shall have a flame spread index of not more than 25 and a smoke-developed index of not more than 450.

780 CMR 720.0 PRESCRIPTIVE FIRE RESISTANCE

720.1 General. The provisions of 780 CMR 720.0 contain prescriptive details of fire-resistance-rated building elements. The materials of construction listed in Tables 720.1(1), 720.1(2), and 720.1(3) shall be assumed to have the fire-resistance ratings prescribed therein. Where materials that change the capacity for heat dissipation are incorporated into a fire-resistance-rated assembly, fire test results or other substantiating data shall be made available to the building official to show that the required fire-resistance-rating time period is not reduced.

720.1.1 Thickness of Protective Coverings. The thickness of fire-resistant materials required for protection of structural members shall be not less than set forth in Table 720.1(1), except as modified in 780 CMR 720.1. The figures shown shall be the net thickness of the protecting materials and shall not include any hollow space in back of the protection.

720.1.2 Unit Masonry Protection. Where required, metal ties shall be embedded in transverse joints of unit masonry for protection of steel columns. Such ties shall be as set forth in Table 720.1(1) or be equivalent thereto.

720.1.3 Reinforcement for Cast-in-place Concrete Column Protection. Cast-in-place concrete protection for steel columns shall be reinforced at the edges of such members with wire ties of not less than 0.18 inch (4.6 mm) in diameter wound spirally around the columns on a pitch of not more than eight inches (203 mm) or by equivalent reinforcement.

720.1.4 Plaster Application. The finish coat is not required for plaster protective coatings where they comply with the design mix and thickness requirements of Tables 720.1(1), 720.1(2) and 720.1(3).

720.1.5 Bonded Prestressed Concrete Tendons. For members having a single tendon or more than one tendon installed with equal concrete cover measured from the nearest surface, the cover shall not be less than that set forth in Table 720.1(1). For members having multiple tendons installed with variable concrete cover, the average tendon cover shall not be less than that set forth in Table 720.1(1), provided:

1. The clearance from each tendon to the nearest exposed surface is used to determine the average cover.
2. In no case can the clear cover for individual

tendons be less than ½ of that set forth in Table 720.1(1). A minimum cover of 0.75 inch (19.1 mm) for slabs and one inch (25 mm) for beams is required for any aggregate concrete.

3. For the purpose of establishing a fire-resistance rating, tendons having a clear covering less than that set forth in Table 720.1(1) shall not contribute more than 50% of the required ultimate moment capacity for members less than 350 square inches (0.226 m^2) in cross-sectional area and 65% for larger members. For structural design purposes, however, tendons having a reduced cover are assumed to be fully effective.

TABLE 720.1(1)
MINIMUM PROTECTION OF STRUCTURAL PARTS BASED ON TIME PERIODS FOR VARIOUS NONCOMBUSTIBLE INSULATING MATERIALS[m]

STRUCTURAL PARTS TO BE PROTECTED	ITEM NUMBER	INSULATING MATERIAL USED	MINIMUM THICKNESS OF INSULATING MATERIAL FOR THE FOLLOWING FIRE-RESISTANCE PERIODS (inches)			
			4 hour	3 hour	2 hour	1 hour
1. Steel columns and all of primary trusses	1-1.1	Carbonate, lightweight and sand-lightweight aggregate concrete, members 6" x 6" or greater (not including sandstone, granite and siliceous gravel).[a]	2½	2	1½	1
	1- 1.2	Carbonate, lightweight and sand-lightweight aggregate concrete, members 8" x 8" or greater (not including sandstone, granite and siliceous gravel).[a]	2	1½	1	1
	1-1.3	Carbonate, lightweight and sand-lightweight aggregate concrete, members 12" x 12" or greater (not including sandstone, granite and siliceous gravel).[a]	1½	1	1	1
	1- 1.4	Siliceous aggregate concrete and concrete excluded in Item 1-1.1, members 6" x 6" or greater.[a]	3	2	1½	1
	1- 1.5	Siliceous aggregate concrete and concrete excluded in Item 1-1.1, members 8" x 8" or greater.[a]	2½	2	1	1
	1-1. 6	Siliceous aggregate concrete and concrete excluded in Item 1-1.1, members 12" x 12" or greater.[a]	2	1	1	1
	1-.2.1	Clay or shale brick with brick and mortar fill.[a]	3¾	—	—	2¼
	1-3. 1	4^ hollow clay tile in two 2" layers; ½" mortar between tile and column; ⅜" metal mesh 0.046^ wire diameter in horizontal joints; tile fill.[a]	4	—	—	—
	1-3.2	2" hollow clay tile; ¾" mortar between tile and column; ⅜" metal mesh 0.046" wire diameter in horizontal joints; limestone concrete fill,[a] plastered with ¾" gypsum plaster.	3	—	—	—
	1-3.3	2" hollow clay tile with outside wire ties 0.08" diameter at each course of tile or ⅜" metal mesh 0.046" diameter wire in horizontal joints; limestone or trap-rock concrete fill[1] extending 1" outside column on all sides	—	—	3	—
	1-3. 4	2" hollow clay tile with outside wire ties 0.08" diameter at each course of tile with or without concrete fill; ¾" mortar between tile and column.	—	—	—	2
	1-4.1	Cement plaster over metal lath wire tied to ¾" cold-rolled vertical channels with 0.049" No. 18 B.W gage) wire ties spaced 3" to 6" on center. Plaster mixed 1.2 ½ by volume, cement to sand.	—	—	2½[b]	⅞
	1-5.1	Vermiculite concrete, 1:4 mix by volume over paperbacked wire fabric lath wrapped directly around column with additional 2" x 2" 0.065"/0.065" (No. 16/16 B.W. gage) wire fabric placed ¾" from outer concrete surface. Wire fabric tied with 0.049^ (No. 18 B.W. gage) wire spaced 6^ on center for inner layer and 2" on center for outer layer.	2	—	—	—
	1-6.1	Perlite or vermiculite gypsum plaster over metal lath wrapped around column and furred 1¼" from column flanges. Sheets lapped at ends and tied at 6" intervals with 0.049" (No. 18 B.W. gage) tie wire. Plaster pushed through to flanges.	1½	1	—	—
	1-6.2	Perlite or vermiculite gypsum plaster over self-furring metal lath wrapped directly around column, lapped 1" and tied at 6" intervals with 0.049" (No. 18 B.W. gage) wire.	1¾	1⅜	1	—
	1-6.3	Perlite or vermiculite gypsum plaster on metal lath applied to ¾" cold-rolled channels spaced 24" apart vertically and wrapped flatwise around column.	1½	—	—	—
	1-6. 4	Perlite or vermiculite gypsum plaster over two layers of ½" plain full-length gypsum lath applied tight to column flanges. Lath wrapped with 1" hexagonal mesh of No. 20 gage wire and tied with doubled 0.035" diameter (No 18 B.W. gage) wire ties spaced 23" on center. For three-coat work, the plaster mix for the second coat shall not exceed 100 pounds of gypsum to 2½" cubic feet of aggregate for the 3-hour system.	2½	2	—	—

TABLE 720.1(1) - continued
MINIMUM PROTECTION OF STRUCTURAL PARTS BASED ON TIME PERIODS FOR VARIOUS NONCOMBUSTIBLE INSULATING MATERIALS[m]

STRUCTURAL PARTS TO BE PROTECTED	ITEM NUMBER	INSULATING MATERIAL USED	MINIMUM THICKNESS OF INSULATING MATERIAL FOR THE FOLLOWING FIRE-RESISTANCE PERIODS (inches)			
			4 hour	3 hour	2 hour	1 hour
1. Steel columns and all of primary trusses (continued)	1-6.5	Perlite or vermiculate gypsum plaster over one layer of ½" plain full-length gypsum lath applied tight to column flanges. Lath tied with doubled 0.049" (No. 18 B.W. gage) wire ties spaced 23" on center and scratch coat wrapped with 1" hexagonal mesh 0.035" (No. 20 B.W. gage) wire fabric. For three-coat work, the plaster mix for the second coat shall not exceed 100 pounds of gypsum to 2½ cubic feet of aggregate.	—	2	—	—
	1-7.1	Multiple layers of ½" gypsum wallboard[c] adhesively[d] secured to column flanges and successive layers. Wallboard applied without horizontal joints. Corner edges of each layer staggered. Wallboard layer below outer layer secured to column with doubled 0.049" (No. 18 B W. gage) steel wire ties spaced 15" on center. Exposed corners taped and treated.	—	—	2	1
	1-7.2	Three layers of ⅝^2 Type X gypsum wallboard[c]. First and second layer held in place by ⅛" diameter by 1⅜" long ring shank nails with 5/16" diameter heads spaced 24" on center at corners. Middle layer also secured with metal straps at mid-height and 18" from each end, and by metal corner bead at each corner held by the metal straps. Third layer attached to corner bead with 1" long gypsum wallboard screws spaced 12" on center.	—	—	1⅞	—
	1-7.3	Three layers of ⅝" Type X gypsum wallboard,[c] each layer screw attached to 1⅝" steel studs 0.018" thick (No. 25 carbon sheet steel gage) at each corner of column. Middle layer also secured with 0.049" (No. 18 B.W. gage) double-strand steel wire ties, 24" on center. Screws are No. 6 by 1" spaced 24" on center for inner layer, No. 6 by 1⅝" spaced 12" on center for middle layer and No. 8 by 2¼" spaced 12" on center for outer layer.	—	1⅞	—	—
	1-8.1	Wood-fibered gypsum plaster mixed 1:1 by weight gypsum-to-sand aggregate applied over metal lath. Lath lapped 1" and tied 6" on center at all end, edges and spacers with 0.049" (No. 18 B.W. gage) steel tie wires. Lath applied over ½" spacers made of ¾" furring channel with 2" legs bent around each corner. Spacers located 1" from top and bottom of member and a maximum of 40" on center and wire tied with a single strand of 0.049" (No. 18 B.W. gage) steel tie wires. Corner bead tied to the lath at 6^2 on center along each corner to provide plaster thickness.	—	—	1⅝	—
2. Webs or flanges of steel beams and girders	2- 1.1	Carbonate, lightweight and sand-lightweight aggregate concrete (not including sandstone, granite and siliceous gravel) with 3" or finer metal mesh placed 1" from the finished surface anchored to the top flange and providing not less than 0.025 square inch of steel area per foot in each direction.	2	1½	1	1
	2-1.2	Siliceous aggregate concrete and concrete excluded in Item 2-1.1 with 3" or finer metal mesh placed 1" from the finished surface anchored to the top flange and providing not less than 0.025 square inch of steel area per foot in each direction.	2½	2	1½	1
	2-2.1	Cement plaster on metal lath attached to ¾" cold-rolled channels with 0.049" (No. 18 B.W. gage) wire ties spaced 3" to 6" on center. Plaster mixed 1:2 ½ by volume, cement to sand.	—	—	2½[b]	⅞
	2-3.1	Vermiculite gypsum plaster on a metal lath cage, wire tied to 0.165" diameter (No. 8 B.W. gage) steel wire hangers wrapped around beam and spaced 16" on center. Metal lath ties spaced approximately 5" on center at cage sides and bottom.	—	⅞	—	—

TABLE 720.1(1) - continued
MINIMUM PROTECTION OF STRUCTURAL PARTS BASED ON TIME PERIODS FOR VARIOUS NONCOMBUSTIBLE INSULATING MATERIALS[m]

STRUCTURAL PARTS TO BE PROTECTED	ITEM NUMBER	INSULATING MATERIAL USED	MINIMUM THICKNESS OF INSULATING MATERIAL FOR THE FOLLOWING FIRE-RESISTANCE PERIODS (inches)			
			4 hour	3 hour	2 hour	1 hour
2. Webs or flanges of steel beams and girders	2-4.1	Two layers of ⅝" Type X gypsum wallboard[c] are attached to U-shaped brackets spaced 24" on center. 0.018" thick (No. 25 carbon sheet steel gage) 1⅝" deep by 1" galvanized steel runner channels are first installed parallel to and on each side of the top beam flange to provide a ½" clearance to the flange. The channel runners are attached to steel deck or concrete floor construction with approved fasteners spaced 12" on center. U-shaped brackets are formed from members identical to the channel runners. At the bent portion of the U-shaped bracket, the flanges of the channel are cut out so that 1⅝" deep corner channels can be inserted without attachment parallel to each side of the lower flange. As an alternate, 0.021" thick (No. 24 carbon sheet steel gage) 1" x 2" runner and corner angles may be used in lieu of channels, and the web cutouts in the U-shaped brackets may be omitted. Each angle is attached to the bracket with ½"-long No. 8 self-drilling screws. The vertical legs of the U-shaped bracket are attached to the runners with one ½" long No. 8 self-drilling screw. The completed steel framing provides a 2⅛" and 1½" space between the inner layer of wallboard and the sides and bottom of the steel beam, respectively. The inner layer of wallboard is attached to the top runners and bottom corner channels or corner angles with 1¼"-long No. 6 self-drilling screws spaced 16" on center. The outer layer of wallboard is applied with 1¾"-long No. 6 self-drilling screws spaced 8" on center. The bottom corners are reinforced with metal corner beads.	—	—	1¼	—
	2-4.2	Three layers of ⅝" Type X gypsum wallboard[c] attached to a steel suspension system as described immediately above utilizing the 0.018" thick (No. 25 carbon sheet steel gage) 1" x 2" lower corner angles. The framing is located so that a 2⅛" and 2" space is provided between the inner layer of wallboard and the sides and bottom of the beam, respectively. The first two layers of wallboard are attached as described immediately above. A layer of 0.035" thick (No. 20 B.W. gage) 1" hexagonal galvanized wire mesh is applied under the soffit of the middle layer and up the sides approximately 2". The mesh is held in position with the No. 6 1⅝"-long screws installed in the vertical leg of the bottom corner angles. The outer layer of wallboard is attached with No. 6 2¼"-long screws spaced 8" on center. One screw is also installed at the mid-depth of the bracket in each layer. Bottom corners are finished as described above.	—	1⅞	—	—
3. Bonded pretensioned reinforcement in prestressed concrete[e]	3-1.1	Carbonate, lightweight, sand-lightweight and siliceous[f] aggregate concrete Beams or girders	4[g]	3[g]	2½	1½
		Solid slabs[h]		2	1½	1
4. Bonded or unbonded post-tensioned tendons in prestressed concretee, [i]	4-1.1	Carbonate, lightweight, sand-lightweight and siliceous[f] aggregate concrete Unrestrained members:				
		Solid slabs[h]	—	2	1½	—
		Beams and girdersj				
		8" wide		4½	2½	1¾
		greater than 12" wide	3	2½	2	1½
	4-1.2	Carbonate, lightweight, sand-lightweight and siliceous aggregate Restrained members:[k]				
		Solid slabs[h]	1¼	1	¾	—
		Beams and girders[j]				
		8" wide	2½	2	1¾	—
		greater than 12" wide	2	1¾	1½	—

TABLE 720.1(1) - continued
MINIMUM PROTECTION OF STRUCTURAL PARTS BASED ON TIME PERIODS FOR VARIOUS NONCOMBUSTIBLE INSULATING MATERIALS[m]

STRUCTURAL PARTS TO BE PROTECTED	ITEM NUMBER	INSULATING MATERIAL USED	MINIMUM THICKNESS OF INSULATING MATERIAL FOR THE FOLLOWING FIRE-RESISTANCE PERIODS (inches)			
			4 hour	3 hour	2 hour	1 hour
5. Reinforcing steel in reinforced concrete columns, beams girders and trusses	5-1.1	Carbonate, lightweight and sand-lightweight aggregate concrete, members 12" or larger, square or round. (Size limit does not apply to beams and girders monolithic with floors.)	1½	1½	1½	1½
		Siliceous aggregate concrete, members 12" or larger, square or round. (Size limit does not apply to beams and girders monolithic with floors.)	2	1½	1½	1½
6. Reinforcing steel in reinforced concrete joists[l]	6-1.1	Carbonate, lightweight and sand-lightweight aggregate concrete.	1¼	1¼	11	¾
	6-1.2	Siliceous aggregate concrete.	1¾	1½		¾
7. Reinforcing and tie rods in floor and roof slabs	7-1.1	Carbonate, lightweight and sand-lightweight aggregate concrete.	1	11	¾	¾
	7-1.2	Siliceous aggregate concrete.	1¼		1	¾

For SI: 1 inch = 25.4 mm, 1 square inch = 645.2 mm^2, 1 cubic foot = 0.0283 m^3.

a. Reentrant parts of protected members to be filled solidly.

b. Two layers of equal thickness with a ¾-inch airspace between.

c. For all of the construction with gypsum wallboard described in Table 720.1(1), gypsum base for veneer plaster of the same size, thickness and core type shall be permitted to be substituted for gypsum wallboard, provided attachment is identical to that specified for the wallboard and the joints on the face layer are reinforced, and the entire surface is covered with a minimum of $^1/_{16}$-inch gypsum veneer plaster.

d. An approved adhesive qualified under ASTM E 119.

e. Where lightweight or sand-lightweight concrete having an oven-dry weight of 110 pounds per cubic foot or less is used, the tabulated minimum cover shall be permitted to be reduced 25%, except that in no case shall the cover be less than ¾ inch in slabs or 1½ inches in beams or girders.

f. For solid slabs of siliceous aggregate concrete, increase tendon cover 20%.

g. Adequate provisions against spalling shall be provided by U-shaped or hooped stirrups spaced not to exceed the depth of the member with a clear cover of one inch.

h. Prestressed slabs shall have a thickness not less than that required in Table 720.1(3) for the respective fire resistance time period.

i. Fire coverage and end anchorages shall be as follows: Cover to the prestressing steel at the anchor shall be ½ inch greater than that required away from the anchor. Minimum cover to steel-bearing plate shall be 1 inch in beams and ¾ inch in slabs.

j. For beam widths between eight inches and 12 inches, cover thickness shall be permitted to be determined by interpolation.

k. Interior spans of continuous slabs, beams and girders shall be permitted to be considered restrained.

l. For use with concrete slabs having a comparable fire endurance where members are framed into the structure in such a manner as to provide equivalent performance to that of monolithic concrete construction.

m. Generic fire-resistance ratings (those not designated as PROPRIETARY* in the listing) in GA 600 shall be accepted as if herein listed.

TABLE 720.1(2)
RATED FIRE-RESISTANCE PERIODS FOR VARIOUS WALLS AND PARTITIONS [a,o,p]

MATERIAL	ITEM NUMBER	CONSTRUCTION	MINIMUM FINISHED THICKNESS FACE-TO-FACE[b] (inches)			
			4 hour	3 hour	2 hour	1 hour
1 Brick of clay or shale	1-1.1	Solid brick of clay or shale[c]	6	4.9	3.8	2.7
	1-1.2	Hollow brick, not filled.	5	4.3	3.4	2.3
	1-1.3	Hollow brick unit wall, grout or filled with perlite vermiculite or expanded shale aggregate.	6.6	5.5	4.4	3
	1-2.1	4" nominal thick units at least 75% solid backed with a hat-shaped metal furring channel ¾" thick formed from 0.021" sheet metal attached to the brick wall on 24" centers with approved fasteners, and ½" Type X gypsum wallboard attached to the metal furring strips with 1"-long Type S screws spaced 8" on center.	—	—	5[d]	—
2. Combination of clay brick and load-bearing hollow clay tile	2-1.1	4" solid brick and 4" tile (at least 40% solid).	—	8	—	—
	2-1.2	4" solid brick and 8" tile (at least 40% solid).	12	—	—	—
3. Concrete masonry units	3-1.1[f, g]	Expanded slag or pumice.	4.7	4	3.2	2.1
	3-1.2[f, g]	Expanded clay, shale or slate.	5.1	4.4	3.6	2.6
	3-1.3[f]	Limestone, cinders or air-cooled slag.	5.9	5	4	2.7
	3-1.4[f, g]	Calcareous or siliceous gravel.	6.2	5.3	4.2	2.8
4. Solid concrete[h, i]	4-1.1	Siliceous aggregate concrete.	7	6.2	5	3.5
		Carbonate aggregate concrete.	6.6	5.7	4.6	3.2
		Sand-lightweight concrete.	5.4	4.6	3.8	2.7
		Lightweight concrete.	5.1	4.4	3.6	2.5
5. Glazed or unglazed facing tile, nonload-bearing	5-1.1	One 2" unit cored 15% maximum and one 4" unit cored 25% maximum with ¾" mortar-filled collar joint. Unit positions reversed in alternate courses.	—	6⅜	—	—
	5-1.2	One 2" unit cored 15% maximum and one 4" unit cored 40% maximum with ¾" mortar-filled collar joint. Unit positions side with ¾" gypsum plaster. Two wythes tied together every fourth course with No. 22 gage corrugated metal ties.	—	6¾	—	—
	5-1.3	One unit with three cells in wall thickness, cored 29% maximum.	—	—	6	—
	5-1.4	One 2" unit cored 22% maximum and one 4" unit cored 41% maximum with ¼" mortar-filled collar joint. Two wythes tied together every third course with 0.030" (No. 22 galvanized sheet steel gage) corrugated metal ties.	—	—	6	—
	5-1.5	One 4" unit cored 25% maximum with ¾" gypsum plaster on one side.	—	—	4¾	—
	5-1.6	One 4" unit with two cells in wall thickness, cored 22% maximum.	—	—	—	4
	5- 1.7	One 4" unit cored 30% maximum with ¾" vermiculite gypsum plaster on one side.	—	—	4½	—
	5-1 8	One 4" unit cored 39% maximum with ¾" gypsum plaster on one side.	—	—	—	4½
6. Solid gypsum plaster	6-1.1	¾ " by 0.055" (No. 16 carbon sheet steel gage) vertical cold-rolled channels, 16" on center with 2.6-pound flat metal lath applied to one face and tied with 0.049" (No. 18 B.W. Gage) wire at 6" spacing. Gypsum plaster each side mixed 1:2 by weight, gypsum to sand aggregate.	—	—	—	2[d]
	6-1.2	¾" by 0.055" (No. 16 carbon sheet steel gage) cold-rolled channels 16" on center with metal lath applied to one face and tied with 0.049" (No. 18 B.W. gage) wire at 6" spacing. Perlite or vermiculite gypsum plaster each side. For three-coat work, the plaster mix for the second coat shall not exceed 100 pounds of gypsum to 2½ cubic feet of aggregate for the one-hour system.	—	—	2½[d]	2[d]
	6-1.3	¾" by 0.055" (No. 16 carbon sheet steel gage) vertical cold-rolled channels, 16" on center with ⅜" gypsum lath applied to one face and attached with sheet metal clips. Gypsum plaster each side mixed 1:2 weight, gypsum to sand aggregate	—	—	—	2[d]

TABLE 720.1(2) - continued
RATED FIRE-RESISTANCE PERIODS FOR VARIOUS WALLS AND PARTITIONS [a,o,p]

MATERIAL	ITEM NUMBER	CONSTRUCTION	MINIMUM FINISHED THICKNESS FACE-TO-FACE[b] (inches)			
			4 hour	3 hour	2 hour	1 hour
6. Solid gypsum plaster - continued	6-2.1	Studless with ½" full-length plain gypsum lath and gypsum plaster each side. Plaster mixed 1:1 for scratch coat and 1:2 for brown coat, by weight, gypsum to sand aggregate.	—	—	—	2[d]
	6-2.2	Studless with ½" full-length plain gypsum lath and perlite or vermiculite gypsum plaster each side	—	—	2½[d]	2[d]
	6-2.3	Studless partition with ⅜" rib metal lath installed vertically adjacent edges tied 6" on center with No. 18 gage wire ties, gypsum plaster each side mixed 1:2 by weight, gypsum to sand aggregate.	—	—	—	2[d]
7 Solid perlite and portland cement	7-1.1	Perlite mixed in the ratio of 3 cubic feet to 100 pounds of portland cement and machine applied to stud side of 1½" mesh by 0.058-inch (No. 17 B.W. gage) paper-backed woven wire fabric lath wire-tied to 4"-deep steel trussed wire[j] studs 16" on center. Wire ties of 0.049" (No. 18 B.W. gage) galvanized steel wire 6" on center vertically.	—	—	3⅛[d]	—
8. Solid neat wood fibered gypsum plaster	8-1.1	¾" by 0.055-inch (No. 16 carbon sheet steel gage) cold-rolled channels, 12" on center with 2.5-pound flat metal lath applied to one face and tied with 0.049" (No. 18 B.W. gage) wire at 6" spacing. Neat gypsum plaster applied each side.	—	—	2[d]	—
9. Solid wallboard partition	9-1.1	One full-length layer ½" Type X gypsum wallboard[e] laminated to each side of 1" full-length V-edge gypsum coreboard with approved laminating compound. Vertical joints of face layer and coreboard staggered at least 3".	—	—	2[d]	—
10. Hollow (studless) gypsum partition wallboard	10-1.1	One full-length layer of ⅝" Type X gypsum wallboard[e] attached to both sides of wood or metal top and bottom runners laminated to each side of 1" x 6" full-length gypsum coreboard ribs spaced 24" on center with approved laminating compound. Ribs centered at vertical joints of face plies and joints staggered 24" in opposing faces. Ribs may be recessed 6" from the top and bottom.	—	—	—	2¼[d]
	10-1.2	1" regular gypsum V-edge full-length backing board attached to both sides of wood or metal top and bottom runners with nails or 1⅝" drywall screws at 24" on center. Minimum width of rumors 1⅝". Face layer of ½" regular full-length gypsum wallboard laminated to outer faces of backing board with approved laminating compound.	—	—	4⅝[d]	—
11. Noncombustible studs—interior partition with plaster each side	11-1.1	3¼" x 0.044" (No. 18 carbon sheet steel gage) steel studs spaced 24" on center. ⅝" gypsum plaster on metal lath each side mixed 1:2 by weight, gypsum to sand aggregate.	—	—	—	4¾[d]
	11-1.2	3⅜" x 0.055" (No. 16 carbon sheet steel gage) approved nailable[k] studs spaced 24" on center. ⅝" neat gypsum wood-fibered plaster each side over ⅜" rib metal lath nailed to studs with 6d common nails, 8" on center. Nails driven 1¼" and bent over.	—	—	5⅝	—
	11-1.3	4" x 0.044" (No. 18 carbon sheet steel gage) channel-shaped steel studs at 16" on center. On each side approved resilient clips pressed onto stud flange at 16" vertical spacing, ¼" pencil rods snapped into or wire tied onto outer loop of clips, metal lath wire-tied to pencil rods at 6" intervals, 1" perlite gypsum plaster, each side.	—	7⅝[d]	—	—
	11-1.4	2½" x 0.044" (No. 18 carbon sheet steel gage) steel studs spaced 16" on center. Wood fibered gypsum plaster mixed 1:1 by weight gypsum to sand aggregate applied on ¾-pound metal lath wire tied to studs, each side. ¾" plaster applied over each face, including finish coat.	—	—	4¼[d]	—
12. Wood studs interior partition with plaster each side	12-1.1[l, m]	2" x 4" wood studs 16" on center with ⅝" gypsum plaster on metal lath. Lath attached by 4d common nails bent over or No. 14 gage by 1¼" by ¾" crown width staples spaced 6" on center. Plaster mixed 1:1½ for scratch coat and 1:3 for brown coat, by weight, gypsum to sand aggregate.	—	—	—	5⅛
	12-1.2[l]	2" x 4" wood studs 16" on center with metal lath and ⅞" neat wood-fibered gypsum plaster each side. Lath attached by 6d common nails, 7" on center. Nails driven 1¼" and bent over.	—	—	5½[d]	—
	12-1.3[l]	2" x 4" wood studs 16" on center with ⅜" perforated or plain gypsum lath and ½" gypsum plaster each side. Lath nailed with 1⅛" by No.13 gage by 19/64" head plasterboard blued nails, 4" on center. Plaster mixed 1:2 by weight, gypsum to sand aggregate.	—	—	—	5¼

TABLE 720.1(2) - continued
RATED FIRE-RESISTANCE PERIODS FOR VARIOUS WALLS AND PARTITIONS [a,o,p]

MATERIAL	ITEM NUMBER	CONSTRUCTION	MINIMUM FINISHED THICKNESS FACE-TO-FACE[b] (inches)			
			4 hour	3 hour	2 hour	1 hour
	12-1.4[l]	2" x 4" wood studs 16" on center with ⅜" Type X gypsum lath and ½" gypsum plaster each side. Lath nailed with 1⅛" by No. 13 gage by 19/64" head plasterboard blued nails, 5" on center. Plaster mixed 1:2 by weight, gypsum to sand aggregate.	—	—	—	5¼
13. Non-cumbustible studs — interior partition with gypsum wallboard each side	13-1.1	0.018" (No. 25 carbon sheet steel gage) channel-shaped studs 24" on center with one full-length layer of ⅝" Type X gypsum wallboard[e] applied vertically attached with 1" long No. 6 drywall screws to each stud. Screws are 8" on center around the perimeter and 12" on center on the intermediate stud. The wallboard may be applied horizontally when attached to 3⅝" studs and the horizontal joints are staggered with those on the opposite side. Screws for the horizontal application shall be 8" on center at vertical edges and 12" on center at intermediate studs.	—	—	—	2⅞[d]
	13-1.2	0.018" (No. 25 carbon sheet steel gage) channel-shaped studs 25" on center with two full-length layers of ½" Type X gypsum wallboard[e] applied vertically each side. First layer attached with 1"-long, No. 6 drywall screws, 8" on center around the perimeter and 12" on center on the intermediate stud. Second layer applied with vertical joints offset one stud space from first layer using 1⅝" long, No 6 drywall screws spaced 9" on center along vertical joints, 12" on center at intermediate studs and 24" on center along top and bottom runners.	—	—	3⅝[d]	—
	13-1.3	0.055" (No. 16 carbon sheet steel gage) approved nailable metal studs[e] 24" on center with full-length ⅝" Type X gypsum wallboard[e] applied vertically and nailed 7" on center with 6d cement-coated common nails. Approved metal fastener grips used with nails at vertical butt joints along studs.	—	—	—	4⅞
14. Wood studs—interior partition with gypsum wallboard each side	14-1.1[h, m]	2" x 4" wood studs 16" on center with two layers of ⅜" regular gypsum wallboard[e] each side, 4d cooler[n] or wallboard[n] nails at 8" on center first layer, 5d cooler[n] or wallboard[n] nails at 8" on center second layer with laminating compound between layers, joints staggered. First layer applied full length vertically, second layer applied horizontally or vertically	—	—	—	5
	14-1.2[l, m]	2" x 4" wood studs 16" on center with two layers ½" regular gypsum wallboard[e] applied vertically or horizontally each side[k], joints staggered. Nail base layer with 5d cooler[n] or wallboard[n] nails at 8" on center face layer with 8d cooler[n] or wallboard[n] nails at 8" on center.	—	—	—	5½
	14-1.3[l, m]	2" x 4" wood studs 24" on center with ⅝" Type X gypsum wallboard[e] applied vertically or horizontally nailed with 6d cooler[n] or wallboard[n] nails at 7"on center vertically with end joints on nailing members. Stagger joints at each side.	—	—	—	4¾
	14-1.4[l]	2" x 4" fire-retardant-treated wood studs spaced 24" on center with one layer of ⅝" Type X gypsum wallboard[e] applied with face paper grain (long dimension) parallel to studs. Wallboard attached with 6d cooler[n] or wallboard[n] nails at 7" on center.	—	—	—	4¾[d]
	14-1.5[l, m]	2" x 4" wood studs 16" on center with two layers ⅝" Type X gypsum wallboard[e] each side. Base layers applied vertically and nailed with 6d cooler[n] or wallboard[n] nails at 9" on center. Face layer applied vertically or horizontally and nailed with 8d cooler[n] or wallboard[n] nails at 7" on center. For nail-adhesive application, base layers are nailed 6" on center. Face layers applied with coating of approved wallboard adhesive and nailed 12" on center.	—	—	6	—
	14-1.6[l]	2" x 3" fire-retardant-treated wood studs spaced 24" on center with one layer of ⅝" Type X gypsum wallboard[e] applied with face paper grain (long dimension) at right angles to studs. Wallboard attached with 6d cement-coated box nails spaced 7" on center.	—	—	—	3⅝[d]
15. Exterior or interior walls	15-1.1[l, m]	Exterior surface with ¾" drop siding over ½" gypsum sheathing on 2" x 4" wood studs at 16" on center, interior surface treatment as required for one-hour-rated exterior or interior 2" x 4" wood stud partitions. Gypsum sheathing nailed with 1¾" by No. 11 gage by 7/16" head galvanized nails at 8" on center. Siding nailed with 7d galvanized smooth box nails.	—	—	—	Varies

TABLE 720.1(2) - continued
RATED FIRE-RESISTANCE PERIODS FOR VARIOUS WALLS AND PARTITIONS [a,o,p]

MATERIAL	ITEM NUMBER	CONSTRUCTION	MINIMUM FINISHED THICKNESS FACE-TO-FACE[b] (inches)			
			4 hour	3 hour	2 hour	1 hour
15. Exterior or interior walls (continued)	15-1.2[l, m]	2" x 4" wood studs 16" on center with metal lath and ¾" cement plaster on each side. Lath attached with 6d common nails 7" on center driven to 1" minimum penetration and bent over. Plaster mix 1:4 for scratch coat and 1:5 for brown coat, by volume, cement to sand.	—	—	—	5⅜
	15-1.3[l, m]	2" x 4" wood studs 16" on center with ⅞" cement plaster (measured from the face of studs) on the exterior surface with interior surface treatment as required for interior wood stud partitions in this table. Plaster mix 1:4 for scratch coat and 1:5 for brown coat, by volume, cement to sand.	—	—	—	Varies
	15-1.4	3⅝" No. 16 gage noncombustible studs 16" on center with ⅞" cement plaster (measured from the face of the studs) on the exterior surface with interior surface treatment as required for interior, nonbearing, noncombustible stud partitions in this table. Plaster mix 1:4 for scratch coat and 1:5 for brown coat, by volume, cement to sand.	—	—	—	Varies
	15-1.5[m]	2¼" x 3¾" clay face brick with cored holes over ½" gypsum sheathing on exterior surface of 2 " x 4 " wood studs at 16 " on center and two layers ⅝" Type X gypsum wallboard[e] on interior surface. Sheathing placed horizontally or vertically with vertical joints over studs nailed 6" on center with 1¾" x No. 11 gage by 7/16" head galvanized nails. Inner layer of wallboard placed horizontally or vertically and nailed 8" on center with 6d cooler[n] or wallboard[n] nails. Outer layer of wallboard placed horizontally or vertically and nailed 8 " on center with 8d cooler[n] or wallboard[n] nails. All joints staggered with vertical joints over studs. Outer layer joints taped and finished with compound. Nail heads covered with joint compound. 0.035 inch (No. 20 galvanized sheet gage) corrugated galvanized steel wall ties ¾" by 6⅝" attached to each stud with two 8d cooler[n] or wallboard[n] nails every sixth course of bricks.	—	—	10	—
	15-1.6[l, m]	2 " x 6 " fire-retardant-treated wood studs 16 " on center. Interior face has two layers of ⅝" Type X gypsum with the base layer placed vertically and attached with 6d box nails 12" on center. The face layer is placed horizontally and attached with 8d box nails 8" on center at joints and 12" on center elsewhere. The exterior face has a base layer of ⅝" Type X gypsum sheathing placed vertically with 6d box nails 8 " on center at joints and 12 " on center elsewhere. An approved building paper is next applied, followed by self-furred exterior lath attached with 2½", No. 12 gage galvanized roofing nails with a ⅜" diameter head and spaced 6 " on center along each stud. Cement plaster consisting of a ½" brown coat is then applied. The scratch coat is mixed in the proportion of 1:3 by weight, cement to sand with ten pounds of hydrated lime and three pounds of approved additives or admixtures per sack of cement. The brown coat is mixed in the proportion of 1.4 by weight, cement to sand with the same amounts of hydrated lime and approved additives or admixtures used in the scratch coat.	—	—	8¼	—
	15-1.7[l, m]	2 " x 6 " wood studs 16 " on center. The exterior face has a layer of ⅝" Type X gypsum sheathing placed vertically with 6d box nails 8 " on center at joints and 12 " on center elsewhere. An approved building paper is next applied, followed by 1" by No. 18 gage self-furred exterior lath attached with 8d by 2½" long galvanized roofing nails spaced 6" on center along each stud. Cement plaster consisting of a ½" scratch coat, a bonding agent and a ½" brown coat and a finish coat is then applied. The scratch coat is mixed in the proportion of 1.3 by weight, cement to sand with ten pounds of hydrated lime and three pounds of approved additives or admixtures per sack of cement The brown coat is mixed in the proportion of 1·4 by weight, cement to sand with the same amounts of hydrated lime and approved additives or admixtures used in the scratch coat. The interior is covered with ⅜" gypsum lath with 1" hexagonal mesh of 0.035 inch (No. 20 B.W. gage) woven wire lath furred out 5/16" and 1" perlite or vermiculite gypsum plaster. Lath nailed with 1⅛" by No. 13 gage by 19/64" head plasterboard glued nails spaced 5" on center. Mesh attached by 1¾" by No. 12 gage by ⅜" head nails with ⅜" furrings, spaced 8 " on center. The plaster mix shall not exceed 100 pounds of gypsum to 2½ cubic feet of aggregate.	—	—	8⅜	—

TABLE 720.1(2) - continued
RATED FIRE-RESISTANCE PERIODS FOR VARIOUS WALLS AND PARTITIONS [a,o,p]

MATERIAL	ITEM NUMBER	CONSTRUCTION	MINIMUM FINISHED THICKNESS FACE-TO-FACE[b] (inches)			
			4 hour	3 hour	2 hour	1 hour
15. Exterior or interior walls (continued)	15-1.8[l, m]	2" x 6" wood studs 16" on center. The exterior face has a layer of ⅝" Type X gypsum sheathing placed vertically with 6d box nails 8" on center at joints and 12" on center elsewhere. An approved building paper is next applied, followed by 1½" by No. 17 gage self-furred exterior lath attached with 8d by 2½" long galvanized roofing nails spaced 6" on center along each stud. Cement plaster consisting of a ½" scratch coat, and a ½" brown coat is then applied. The plaster may be placed by machine. The scratch coat is mixed in the proportion of 1:4 by weight, plastic cement to sand. The brown coat is mixed in the proportion of 1:5 by weight, plastic cement to sand. The interior is covered with ⅜" gypsum lath with 1" hexagonal mesh of No. 20 gage woven wire lath furred out 5/16" and 1" perlite or vermiculite gypsum plaster. Lath nailed with 1⅛" by No. 13 gage by 19/64" head plasterboard glued nails spaced 5 " on center. Mesh attached by 1¾" by No. 12 gage by ⅜" head nails with ⅜" furrings, spaced 8" on center. The plaster mix shall not exceed 100 pounds of gypsum to 2½ cubic feet of aggregate.	—	—	8⅜	—
	15-1.9	4" No. 18 gage, nonload-bearing metal studs, 16" on center, with 1" portland cement lime plaster [measured from the back side of the ¾-pound expanded metal lath] on the exterior surface. Interior surface to be covered with 1" of gypsum plaster on ¾-pound expanded metal lath proportioned by weight—1:2 for scratch coat, 1:3 for brown, gypsum to sand. Lath on one side of the partition fastened to ¼" diameter pencil rods supported by No. 20 gage metal clips, located 16" on center vertically, on each stud. 3" thick mineral fiber insulating batts friction fitted between the studs.	—	—	6½[d]	—
	15-1.10	Steel studs 0.060" thick, 4" deep or 6" at 16" or 24" centers, with ½" Glass Fiber Reinforced Concrete (GFRC) on the exterior surface. GFRC is attached with flex anchors at 24" on center, with 5" leg welded to studs with two ½"-long flare-bevel welds, and 4" foot attached to the GFRC skin with ⅝" thick GFRC bonding pads that extend 2½" beyond the flex anchor foot on both sides. Interior surface to have two layers of ½" Type X gypsum wallboard.[e] The first layer of wallboard to be attached with 1"-long Type S buglehead screws spaced 24" on center and the second layer is attached with 1⅝"-long Type S screws spaced at 12" on center. Cavity is to be filled with 5" of 4 pcf (nominal) mineral fiber batts. GFRC has 1½" returns packed with mineral fiber and caulked on the exterior.	—	—	6½	—
	15-1.11	Steel studs 0 060" thick, 4" deep or 6" at 16" or 24" centers, respectively, with ½" Glass Fiber Reinforced Concrete (GFRC) on the exterior surface. GFRC is attached with flex anchors at 24" on center, with 5" leg welded to studs with two ½"-long flare-bevel welds, and 4" foot attached to the GFRC skin with ⅝"-thick GFRC bonding pads that extend 2½" beyond the flex anchor foot on both sides. Interior surface to have one layer of ⅝" Type X gypsum wallboard[e], attached with ¼"-long Type S buglehead screws spaced 12" on center. Cavity is to be filled with 5" of 4 pcf (nominal) mineral fiber batts. GFRC has 1½ " returns packed with mineral fiber and caulked on the exterior.	—	—	—	6⅛
	15-1.12[q]	2" x 6" wood studs at 16" with double top plates, single bottom plate; interior and exterior sides covered with ⅝" Type X gypsum wallboard, 4' wide, applied horizontally or vertically with vertical joints over studs, and fastened with 2¼" Type S drywall screws, spaced 12" on center.	—	—	—	6¾
	15-1. 13[q]	2" x 6" wood studs at 16" with double top plates, single bottom plate; interior and exterior sides covered with ⅝" Type X gypsum wallboard, 4' wide, applied horizontally or vertically with vertical joints over studs, and fastened with 2¼" Type S drywall screws, spaced 7" on center. Cavity to be filled with 5½" ineral wool insulation minimum 2.58 pcf (nominal).	—	—	—	6¾
	15-1. 14[q]	2" x 4" wood studs at 16" with double top plates, single bottom plate; interior and exterior sides covered with ⅝" Type X gypsum wallboard and sheathing, respectively, 4' wide, applied horizontally or vertically with vertical joints over studs, and fastened with 2¼" Type S drywall screws, spaced 12" on center. Cavity to be filled with 3½" mineral wool insulation.	—	—	—	4¾

TABLE 720.1(2) - continued
RATED FIRE-RESISTANCE PERIODS FOR VARIOUS WALLS AND PARTITIONS [a,o,p]

MATERIAL	ITEM NUMBER	CONSTRUCTION	MINIMUM FINISHED THICKNESS FACE-TO-FACE[b] (inches)			
			4 hour	3 hour	2 hour	1 hour
15. Exterior or interior walls (continued)	15-1.15[q]	2" x 6" wood studs at 24" centers with double top plates, single bottom plate; interior and exterior side covered with two layers of ⅝" Type X gypsum wallboard, 4' wide, applied horizontally with vertical joints over studs. Base layer fastened with 2¼" Type S drywall screws, spaced 24" on center, and face layer fastened with Type S drywall screws, spaced 8" on center, wallboard joints covered with paper tape and joint compound, fastened heads covered with joint compound. Cavity to be filled with 5½" mineral wool insulation.	—	—	7¾	—
16. Exterior walls rated for fire resistance from the inside only in accordance with 780 CMR 704.5.	16-1.1[q]	2" x 4" wood studs at 16" centers with double top plates, single bottom plate; interior side covered with ⅝" Type X gypsum wallboard, 4' wide, applied horizontally unblocked, and fastened with 2¼" Type S drywall screws, spaced 12" on center, wallboard joints covered with paper tape and joint compound, fastener heads covered with joint compound. Exterior covered with ⅜" wood structural panels (oriented strand board), applied vertically, horizontal joints blocked and fastened with 6d common nails (bright) — 12" on center in the field, and 6 on center panel edges. Cavity to be filled with 3½" mineral wool insulation. Rating established for exposure from interior side only.	—	—	—	4½

For SI: 1 inch = 25.4 mm, 1 square inch = 645.2 mm^2, 1 cubic foot = 0.0283 m^3.

a. Staples with equivalent holding power and penetration shall be permitted to be used as alternate fasteners to nails for attachment to wood framing.

b. Thickness shown for brick and clay tile are nominal thicknesses unless plastered, in which case thicknesses are net. Thickness shown for concrete masonry and clay masonry is equivalent thickness defined in 780 CMR 721.3.1 for concrete masonry and 780 CMR 721.4.1.1 for clay masonry. Where all cells are solid grouted or filled with silicone-treated perlite loose-fill insulation; vermiculite loose-fill insulation; or expanded clay, shale or slate lightweight aggregate, the equivalent thickness shall be the thickness of the block or brick using specified dimensions as defined in 780 CMR 21.00. Equivalent thickness may also include the thickness of applied plaster and lath or gypsum wallboard, where specified.

c. For units in which the net cross-sectional area of cored brick in any plane parallel to the surface containing the cores is at least 75% of the gross cross-sectional area measured in the same plane.

d. Shall be used for nonbearing purposes only.

e. For all of the construction with gypsum wallboard described in this table, gypsum base for veneer plaster of the same size, thickness and core type shall be permitted to be substituted for gypsum wallboard, provided attachment is identical to that specified for the wallboard, and the joints on the face layer are reinforced and the entire surface is covered with a minimum of $^1/_{16}$-inch gypsum veneer plaster.

f. The fire-resistance time period for concrete masonry units meeting the equivalent thicknesses required for a two-hour fire-resistance rating in Item 3, and having a thickness of not less than 7⅝ inches is four hours when cores which are not grouted are filled with silicone-treated perlite loose-fill insulation; vermiculite loose-fill insulation; or expanded clay, shale or slate lightweight aggregate, sand or slag having a maximum particle size of ⅜ inch.

g. The fire-resistance rating of concrete masonry units composed of a combination of aggregate types or where plaster is applied directly to the concrete masonry shall be determined in accordance with ACI 216.1/TMS 216. Lightweight aggregates shall have a maximum combined density of 65 pounds per cubic foot.

h. See also Note b. The equivalent thickness shall be permitted to include the thickness of cement plaster or 1.5 times the thickness of gypsum plaster applied in accordance with the requirements of 780 CMR 25.00.

i. Concrete walls shall be reinforced with horizontal and vertical temperature reinforcement as required by 780 CMR 19.00.

j. Studs are welded truss wire studs with 0.18 inch (No. 7 B.W. gage) flange wire and 0.18 inch (No. 7 B.W. gage) truss wires.

k. Nailable metal studs consist of two channel studs spot welded back to back with a crimped web forming a nailing groove.

l. Wood structural panels shall be permitted to be installed between the fire protection and the wood studs on either the interior or exterior side of the wood frame assemblies in this table, provided the length of the fasteners used to attach the fire protection are increased by an amount at least equal to the thickness of the wood structural panel.

m. The design stress of studs shall be reduced to 78% of allowable F_c with the maximum not greater than 78% of the calculated stress with studs having a slenderness ratio l_e/d of 33.

n. For properties of cooler or wallboard nails, see ASTM C 514, ASTM C 547 or ASTM F 1667.

o. Generic fire-resistance ratings (those not designated as PROPRIETARY* in the listing) in the GA 600 shall be accepted as if herein listed.

p. NCMA TEK 5-8, shall be permitted for the design of fire walls.

q. The design stress of studs shall be equal to a maximum of 100% of the allowable F_c calculated in accordance with 780 CMR 2306.0.

TABLE 720.1(3)
MINIMUM PROTECTION FOR FLOOR AND ROOF SYSTEMS[a,q]

FLOOR OR ROOF CONSTRUCTION	ITEM NUMBER	CEILING CONSTRUCTION	THICKNESS OF FLOOR OR ROOF SLAB (inches)				MINIMUM THICKNESS OF CEILING (inches)			
			4 hour	3 hour	2 hour	1 hour	4 hour	3 hour	2 hour	1 hour
1. Siliceous aggregate concrete	1-1.1	Slab (no ceiling required). Minimum cover over nonprestressed reinforcement shall not be less than ¾ inch [b]	7	6 2	5	3.5	—	—	—	—
2. Carbonate aggregate concrete	2-1.1		6.6	5.7	4.6	3.2	—	—	—	—
3. Sand-lightweight concrete	3-1.1		5.4	4.6	3.8	2.7	—	—	—	—
4. Lightweight concrete	4-1.1		5.1	4.4	3.6	2.5	—	—	—	—
5. Reinforced concrete	5-1.1	Slab with suspended ceiling of vermiculite gypsum plaster over metal lath attached to ¾" cold-rolled channels spaced 12" on center. Ceiling located 6" minimum below joists.	3	2	—	—	1	¾	—	—
	5-2.1	⅝" Type X gypsum wallboard[c] attached to 0.018 inch (No. 25 carbon sheet steel gage) by ⅞" deep by 2⅝" hat-shaped galvanized steel channels with 1"-long No. 6 screws. The channels are spaced 24" on center, span 35" and are supported along their length at 35" intervals by 0.033-inch (No. 21 galvanized sheet gage) galvanized steel flat strap hangers having formed edges that engage the lips of the channel. The strap hangers are attached to the side of the concrete joists with 5/32" by 1¼" long power-driven fasteners. The wallboard is installed with the long dimension perpendicular to the channels. All end joints occur on channels and supplementary channels are installed parallel to the main channels, 12" each side, at end joint occurrences. The finished ceiling is located approximately 12" below the soffit of the floor slab.	—	—	2½	—	—	—	⅝	—
6. Steel joists constructed with a poured reinforced concrete slab on metal lath forms or steel form units[d, e]	6- 1.1	Gypsum plaster on metal lath attached to the bottom cord with single No. 16 gage or doubled No. 18 gage wire ties spaced 6" on center. Plaster mixed 1:2 for scratch coat, 1:3 for brown coat, by weight, gypsum-to-sand aggregate for two-hour system. For three-hour system plaster is neat.	—	—	2½	2¼	—	—	¾	⅝
	6-2.1	Vermiculite gypsum plaster on metal lath attached to the bottom chord with single No.16 gage or doubled 0.049-inch (No. 18 B.W. gage) wire ties 6" on center.	—	2	—	—	—	⅝	—	—
	6-3.1	Cement plaster over metal lath attached to the bottom chord of joists with single No. 16 gage or doubled 0.049-inch (No. 18 B.W. gage) wire ties spaced 6" on center. Plaster mixed 1:2 for scratch coat, 1:3 for brown coat for one-hour system and 1:1 for scratch coat, 1·1 ½ for brown coat for two-hour system, by weight, cement to sand.	—	—	—	2	—	—	—	⅝[f]

TABLE 720.1(3)- continued
MINIMUM PROTECTION FOR FLOOR AND ROOF SYSTEMS[a-q]

FLOOR OR ROOF CONSTRUCTION	ITEM NUMBER	CEILING CONSTRUCTION	THICKNESS OF FLOOR OR ROOF SLAB (inches)				MINIMUM THICKNESS OF CEILING (inches)			
			4 hour	3 hour	2 hour	1 hour	4 hour	3 hour	2 hour	1 hour
6. Steel joists constructed with a poured reinforced concrete slab on metal lath forms or steel form units[d, e] - continued	6-4.1	Ceiling of ⅝" Type X wallboard[c] attached to ⅞" deep by 2⅝" by 0.021 inch (No. 25 carbon sheet steel gage) hat-shaped furring channels 12" on center with 1" long No. 6 wallboard screws at 8" on center. Channels wire tied to bottom chord of joists with doubled 0.049 inch (No. 18 B.W. gage) wire or suspended below joists on wire hangers.[g]	—	—	2½	—	—	—	⅝	—
	6-5. 1	Wood-fibered gypsum plaster mixed 1:1 by weight gypsum to sand aggregate applied over metal lath. Lath tied 6" on center to ¾" channels spaced 13½" on center. Channels secured to joists at each intersection with two strands of 0.049 inch (No. 18 B.W. gage) galvanized wire.	—	—	2½	—	—	—	¾	—
7. Reinforced concrete slabs and joists with hollow clay tile fillers laid end to end in rows 2½" or more apart; reinforcement placed between rows and concrete cast around and over tile.	7-1.1	⅝" gypsum plaster on bottom of floor or roof construction.	—	—	8[h]	—	—	—	⅝	—
	7-1.2	None	—	—	—	5½[i]	—	—	—	—
8 Steel joists constructed with a reinforced concrete slab on top poured on a ½" deep steel deck.[e]	8-1.1	Vermiculite gypsum plaster on metal lath attached to ¾" cold-rolled channels with 0.049" (No. 18 B.W. gage) wire ties spaced 6" on center.	2½[j]	—	—	—	¾	—	—	—
9. 3" deep cellular steel deck with concrete slab on top. Slab thickness measured to top.	9-1 1	Suspended ceiling of vermiculite gypsum plaster base coat and vermiculite acoustical plaster on metal lath attached at 6" intervals to ¾" cold-rolled channels spaced 12" on center and secured to 1½" cold-rolled channels spaced 36" on center with 0.065" (No. 16 B.W. gage) wire. 1½" channels supported by No. 8 gage wire hangers at 36" on center. Beams within envelope and with a 2½" airspace between beam soffit and lath have a four-hour rating.	2½	—	—	—	1⅛[k]	—	—	—
10. 1½"-deep steel roof deck on steel framing. Insulation board, 30 pcf density, composed of wood fibers with cement binders of thickness shown bonded to deck with unified asphalt adhesive. Covered with a Class A or B roof covering.	10-1.1	Ceiling of gypsum plaster on metal lath Lath attached to ¾" furring channels with 0.049" (No. 18 B.W. gage) wire ties spaced 6" on center. ¾" channel saddle tied to 2" channels with doubled 0.065" (No. 16 B.W. gage) wire ties. 2" channels spaced 36" on center suspended 2" below steel framing and saddle-tied with 0.165" (No. 8 B.W. gage) wire. Plaster mixed 1:2 by weight, gypsum-to-sand aggregate.	—	—	1⅞	1	—	—	¾1	¾[l]

TABLE 720.1(3)- continued
MINIMUM PROTECTION FOR FLOOR AND ROOF SYSTEMS[a,q]

FLOOR OR ROOF CONSTRUCTION	ITEM NUMBER	CEILING CONSTRUCTION	THICKNESS OF FLOOR OR ROOF SLAB (inches)				MINIMUM THICKNESS OF CEILING (inches)			
			4 hour	3 hour	2 hour	1 hour	4 hour	3 hour	2 hour	1 hour
11. 1½"-deep steel roof deck on steel-framing wood fiber insulation board, 17.5 pcf density on top applied over a 15-lb asphalt-saturated felt. Class A or B roof covering.	11-1.1	Ceiling of gypsum plaster on metal lath. Lath attached to ¾" furring channels with 0.049" (No. 18 B.W. gage) wire ties spaced 6" on center. ¾" channels saddle tied to 2" channels with doubled 0.065" (No. 16 B.W. gage) wire ties. 2" channels spaced 36" on center suspended 2" below steel framing and saddle tied with 0.165" (No. 8 B.W. gage) wire. Plaster mixed 1.2 for scratch coat and 1:3 for brown coat, by weight, gypsum-to-sand aggregate for one-hour system. For two-hour system, plaster mix is 1:2 by weight, gypsum-to-sand aggregate.	—	—	1½	1	—	—	⅞[g]	1¾
12. 1½^{2} deep steel roof deck on steel-framing insulation of rigid board consisting of expanded perlite and fibers impregnated with integral asphalt waterproofing; density 9 to 12 pcf secured to metal roof deck by ½" wide ribbons of waterproof, cold-process liquid adhesive spaced 6^{2} apart. Steel joist or light steel construction with metal roof deck, insulation, and Class A or B built-up roof covering.[e]	12-1.1	Gypsum-vermiculite plaster on metal lath wire tied at 6" intervals to ¾" furring channels spaced 12" on center and wire tied to 2" runner channels spaced 32" on center. Runners wire tied to bottom chord of steel joists.	—	—	1	—	—	—	⅞	—
13. Double wood floor over wood joists spaced 16" on center.[m,n]	13-1.1	Gypsum plaster over ⅜" Type X gypsum lath. Lath initially applied with not less than four 1⅛" by No. 13 gage by 19/64" head plasterboard blued nails per bearing. Continuous stripping over lath along all joist lines. Stripping consists of 3" wide strips of metal lath attached by 1½" by No. 11 gage by ½" head roofing nails spaced 6" on center. Alternate stripping consists of 3" wide 0.049" diameter wire stripping weighing one pound per square yard and attached by No.16 gage by 1½" by ¾" crown width staples, spaced 4" on center. Where alternate stripping is used, the lath nailing may consist of two nails at each end and one nail at each intermediate bearing. Plaster mixed 1:2 by weight, gypsum-to-sand aggregate.								⅞
	13-1.2	Cement or gypsum plaster on metal lath. Lath fastened with 1½" by No. 11 gage by 7/16" head barbed shank roofing nails spaced 5" on center. Plaster mixed 1:2 for scratch coat and 1:3 for brown coat, by weight, cement to sand aggregate.								⅝

TABLE 720.1(3)- continued
MINIMUM PROTECTION FOR FLOOR AND ROOF SYSTEMS[a,q]

FLOOR OR ROOF CONSTRUCTION	ITEM NUMBER	CEILING CONSTRUCTION	THICKNESS OF FLOOR OR ROOF SLAB (inches)				MINIMUM THICKNESS OF CEILING (inches)			
			4 hour	3 hour	2 hour	1 hour	4 hour	3 hour	2 hour	1 hour
13. Double wood floor over wood joists spaced 16" on center.[m,n] - continued	13-1.3	Perlite or vermiculite gypsum plaster on metal lath secured to joists with 1½" by No. 11 gage by $^{7}/_{16}$" head barbed shank roofing nails spaced 5" on center.								⅝
	13-1.4	½" Type X gypsum wallboard[c] nailed to joists with 5d cooler[o] or wallboard[o] nails at 6" on center. End joints of wallboard centered on joists.								½
14. Plywood stressed skin panels consisting of ⅝"-thick interior C-D (exterior glue) top stressed skin on 2" x 6" nominal (minimum) stringers. Adjacent panel edges joined with 8d common wire nails spaced 6" on center. Stringers spaced 12" maximum on center.	14-1.1	½"-thick wood fiberboard weighing 15 to 18 pounds per cubic foot installed with long dimension parallel to stringers or ⅜" C-D (exterior glue) plywood glued and/or nailed to stringers. Nailing to be with 5d cooler[o] or wallboard[o] nails at 12" on center. Second layer of ½" Type X gypsum wallboard[c] applied with long dimension perpendicular to joists and attached with 8d cooler[o] or wallboard[o] nails at 6" on center at end joints and 8" on center elsewhere. Wallboard joints staggered with respect to fiberboard joints.								1
15. Vermiculite concrete slab proportioned 1:4 (portland cement to vermiculite aggregate) on a 1½"-deep steel deck supported on individually protected steel framing. Maximum span of deck 6"-10" where deck is less than 0.019 inch (No. 26 carbon steel sheet gage) or greater. Slab reinforced with 4" x 8" 0.109/0.083" (No. $^{12}/_{14}$ B.W. gage) welded wire mesh.	15-1.1	None	—	—	—	3[j]	—	—	—	—
16. Perlite concrete slab proportioned 1:6 (portland cement to perlite aggregate) on a 1¼"-deep steel deck supported on individually protected steel framing. Slab reinforced with 4" x 8" 0.109/0.083" (No. $^{12}/_{14}$ B.W. gage) welded wire mesh.	16-1.1	None	—	—	—	3½[j]	—	—	—	—
17. Perlite concrete slab proportioned 1:6 (portland cement to perlite aggregate) on a $^{9}/_{16}$"-deep steel deck supported by steel joists 4" on center. Class A or B roof covering on top.	17-1.1	Perlite gypsum plaster on metal lath wire tied to ¾" furring channels attached with 0.065-inch (No. 16 B.W. gage) wire ties to lower chord of joists.	—	2[p]	2[p]	—	—	⅞	¾	—

TABLE 720.1(3)- continued
MINIMUM PROTECTION FOR FLOOR AND ROOF SYSTEMS[a,q]

FLOOR OR ROOF CONSTRUCTION	ITEM NUMBER	CEILING CONSTRUCTION	THICKNESS OF FLOOR OR ROOF SLAB (inches)				MINIMUM THICKNESS OF CEILING (inches)			
			4 hour	3 hour	2 hour	1 hour	4 hour	3 hour	2 hour	1 hour
18. Perlite concrete slab proportioned 1:6 (portland cement to perlite aggregate) on 1¼"-deep steel deck supported on individually protected steel framing. Maximum span of deck 6'-10" where deck is less than 0.019" (No. 26 carbon sheet steel gage) and 8'-0" where deck is 0.019" (No. 26 carbon sheet steel gage) or greater. Slab reinforced with 0.042" (No. 19 B.W. gage) hexagonal wire mesh. Class A or B roof covering on top.	18-1.1	None	—	2¼[p]	2¼[p]	—	—	—	—	—
19. Floor and beam construction consisting of 3"-deep cellular steel floor unit mounted on steel members with 1:4 (proportion of portland cement to perlite aggregate) perlite-concrete floor slab on top.	19-1.1	Suspended envelope ceiling of perlite gypsum plaster on metal lath attached to ¾" cold-rolled channels, secured to 1½" cold-rolled channels spaced 42" on center supported by 0.203 inch (No. 6 B.W. gage) wire 36" on center. Beams in envelope with 3" minimum airspace between beam soffit and lath have a four-hour rating.	2[p]	—	—	—	1[l]	—	—	—

TABLE 720.1(3)- continued
MINIMUM PROTECTION FOR FLOOR AND ROOF SYSTEMS[a,q]

FLOOR OR ROOF CONSTRUCTION	ITEM NUMBER	CEILING CONSTRUCTION	THICKNESS OF FLOOR OR ROOF SLAB (inches)				MINIMUM THICKNESS OF CEILING (inches)			
			4 hour	3 hour	2 hour	1 hour	4 hour	3 hour	2 hour	1 hour
20. Perlite concrete proportioned 1:6 (portland cement to perlite aggregate) poured to ⅛-inch thickness above top of corrugations of $1^{5}/_{16}$"-deep galvanized steel deck maximum span 8'-0" for 0 024-inch (No. 24 galvanized sheet gage) or 6' 0" for 0.019-inch (No. 26 galvanized sheet gage) with deck supported by individually protected steel framing. Approved polystyrene foam plastic insulation board having a flame spread not exceeding 75 (1" to 4" thickness) with vent holes that approximate 3% of the board surface area placed on top of perlite slurry. A 2' by 4' insulation board contains six 2¾" diameter holes. Board covered with 2¼" minimum perlite concrete slab. Slab reinforced with mesh consisting of 0.042 inch (No. 19 B.W. gage) galvanized steel wire twisted together to form 2" hexagons with straight 0.065 inch (No. 16 B.W. gage) galvanized steel wire woven into mesh and spaced 3". Alternate slab reinforcement shall be permitted to consist of 4" x 8", 0.109/ 0.238-inch (No. 12/4 B.W. gage), or 2" x 2", 0 083/0.083-inch (No. 14/14 B.W. gage) welded wire fabric. Class A or B roof covering on top.	20-1.1	None	—	—	Varies	—	—	—	—	—

TABLE 720.1(3)- continued
MINIMUM PROTECTION FOR FLOOR AND ROOF SYSTEMS[a-q]

FLOOR OR ROOF CONSTRUCTION	ITEM NUMBER	CEILING CONSTRUCTION	THICKNESS OF FLOOR OR ROOF SLAB (inches)				MINIMUM THICKNESS OF CEILING (inches)			
			4 hour	3 hour	2 hour	1 hour	4 hour	3 hour	2 hour	1 hour
21. Wood joists, floor trusses and flat or pitched roof trusses spaced a maximum 24" o.c with ½" wood structural panels with exterior glue applied at right angles to top of joist or top chord of trusses with 8d nails. The wood structural panel thickness shall not be less than nominal ½" less than required by 780 CMR 23.00.	21-1.1	Base layer ⅝" Type X gypsum wallboard applied at right angles to joist or truss 24" o.c. with 1¼" Type S or Type W drywall screws 24" o.c. Face layer ⅝" Type X gypsum wallboard or veneer base applied at right angles to joist or truss through base layer with 1⅞" Type S or Type W drywall screws 12" o.c. at joints and intermediate joist or truss. Face layer Type G drywall screws placed 2" back on either side of face layer end joints, 12 o.c.	—	—	—	Varies	—	—	—	1¼
22. Steel joists, floor trusses and flat or pitched roof trusses spaced a maximum 24" o.c. with ½" wood structural panels with exterior glue applied at right angles to top of joist or top chord of trusses with No. 8 screws. The wood structural panel thickness shall not be less than nominal ½" nor less than required by 780 CMR 23.00.	22-1.1	Base layer ⅝" Type X gypsum board applied at right angles to steel framing 24" on center with 1" Type S drywall screws spaced 24" on center. Face layer ⅝" Type X gypsum board applied at right angles to steel framing attached through base layer with 1⅝" Type S drywall screws 12" on center at end joints and intermediate joints and 1½ Type G drywall screws 12 inches on center placed 2" back on either side of face layer end joints. Joints of the face layer are offset 24" from the joints of the base layer.	—	—	—	Varies	—	—	—	1¼
23. Wood I-joist (minimum joist depth 9¼" with a minimum flange depth of 15/16" and a minimum flange cross- sectional area of 2.3 square inches) at 24" o.c. spacing with 1 x 4 (nominal) wood furring strip spacer applied parallel to and covering the bottom of the bottom flange of each member, tacked in place. 2" mineral fiber insulation, 3.5 pcf (nominal) installed adjacent to the bottom flange of the I-joist and supported by the 1 x 4 furring strip spacer.	23-1.1	½" deep single leg resilient channel 16" on center (channels doubled at wallboard end joints), placed perpendicular to the furring strip and joist and attached to each joist by 1⅞" Type S drywall screws. ⅝" Type C gypsum wallboard applied perpendicular to the channel with end joints staggered at least 4" and fastened with 1⅛" Type S drywall screws spaced 7" on center. Wallboard joints to be taped and covered with joint compound.	—	—	—	Varies	—	—	—	—

Table 720.1(3) Notes.

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound = 0.454 kg, 1 cubic foot = 0.0283 m^3,
1 pound per square inch = 6.895 kPa = 1 pound per lineal foot = 1.4882 kg/m.

a. Staples with equivalent holding power and penetration shall be permitted to be used as alternate fasteners to nails for attachment to wood framing.

b. When the slab is in an unrestrained condition, minimum reinforcement cover shall not be less than 1⅝ inches for four-hour (siliceous aggregate only); 1¼ inches for four- and three-hour; one inch for two-hour (siliceous aggregate only); and ¾ inch for all other restrained and unrestrained conditions.

c. For all of the construction with gypsum wallboard described in this table, gypsum base for veneer plaster of the same size, thickness and core type shall be permitted to be substituted for gypsum wallboard, provided attachment is identical to that specified for the wallboard, and the joints on the face layer are reinforced and the entire surface is covered with a minimum of $^{1}/_{16}$-inch gypsum veneer plaster.

d. Slab thickness over steel joists measured at the joists for metal lath form and at the top of the form for steel form units.

e. (a) The maximum allowable stress level for H-Series joists shall not exceed 22,000 psi.
(b) The allowable stress for K-Series joists shall not exceed 26,000 psi, the nominal depth of such joist shall not be less than ten inches and the nominal joist weight shall not be less than five pounds per lineal foot.

f. Cement plaster with 15 pounds of hydrated lime and three pounds of approved additives or admixtures per bag of cement.

g. Gypsum wallboard ceilings attached to steel framing shall be permitted to be suspended with $1^{1}/_{2}$-inch cold-formed carrying channels spaced 48 inches on center, which are suspended with No. 8 SWG galvanized wire hangers spaced 48 inches on center. Cross-furring channels are tied to the carrying channels with No. 18 SWG galvanized wire hangers spaced 48 inches on center. Cross-furring channels are tied to the carrying channels with No. 18 SWG galvanized wire (double strand) and spaced as required for direct attachment to the framing. This alternative is also applicable to those steel framing assemblies recognized under Note q.

h. Six-inch hollow clay tile with two-inch concrete slab above.

i. Four-inch hollow clay tile with $1^{1}/_{2}$-inch concrete slab above.

j. Thickness measured to bottom of steel form units.

k. ⅝ inch of vermiculite gypsum plaster plus $^{1}/_{2}$ inch of approved vermiculite acoustical plastic.

l. Furring channels spaced 12 inches on center.

m. Double wood floor shall be permitted to be either of the following:
   (a) Subfloor of one-inch nominal boarding, a layer of asbestos paper weighing not less than 14 pounds per 100 square feet and a layer of one-inch nominal tongue-and-groove finished flooring; or
   (b) Subfloor of one-inch nominal tongue-and-groove boarding or $^{15}/_{32}$-inch wood structural panels with exterior glue and a layer of one-inch nominal tongue-and-groove finished flooring or $^{19}/_{32}$-inch wood structural panel finish flooring or a layer of Type I Grade M-1 particleboard not less than ⅝-inch thick.

n. The ceiling shall be permitted to be omitted over unusable space, and flooring shall be permitted to be omitted where unusable space occurs above.

o. For properties of cooler or wallboard nails, see ASTM C 514, ASTM C 547 or ASTM F 1667.

p. Thickness measured on top of steel deck unit.

q. Generic fire-resistance ratings (those not designated as PROPRIETARY* in the listing) in the GA 600 shall be accepted as if herein listed.

780 CMR 721.0 CALCULATED FIRE RESISTANCE

721.1 General. The provisions of 780 CMR 721.0 contain procedures by which the fire resistance of specific materials or combinations of materials is established by calculations. These procedures apply only to the information contained in 780 CMR 721.0 and shall not be otherwise used. The calculated fire resistance of concrete, concrete masonry, and clay masonry assemblies shall be permitted in accordance with ACI 216.1/TMS 0216.1. The calculated fire resistance of steel assemblies shall be permitted in accordance with Chapter 5 of ASCE/SFPE 29.

721.1.1 Definitions. The following words and terms shall, for the purposes of 780 CMR 7.00 and as used elsewhere in 780 CMR, have the meanings shown in 780 CMR 721.1.1.

CERAMIC FIBER BLANKET. A mineral wool insulation material made of alumina-silica fibers and weighing four to ten pounds per cubic foot (pcf) (64 to 160 kg/m^3).

CONCRETE, CARBONATE AGGREGATE. Concrete made with aggregates consisting mainly of calcium or magnesium carbonate, such as limestone or dolomite, and containing 40% or less quartz, chert, or flint.

CONCRETE, CELLULAR. A lightweight insulating concrete made by mixing a preformed foam with portland cement slurry and having a dry unit weight of approximately 30 pcf (480 kg/m^3).

CONCRETE, LIGHTWEIGHT AGGREGATE. Concrete made with aggregates of expanded clay, shale, slag or slate or sintered fly ash or any natural lightweight aggregate meeting ASTM C 330 and possessing equivalent fire-resistance properties and weighing 85 to 115 pcf (1360 to 1840 kg/m^3).

CONCRETE, PERLITE. A lightweight insulating concrete having a dry unit weight of approximately 30 pcf (480 kg/m^3) made with perlite concrete aggregate. Perlite aggregate is produced from a volcanic rock which, when heated, expands to form a glass-like material of cellular structure.

CONCRETE, SAND-LIGHTWEIGHT. Concrete made with a combination of expanded clay, shale, slag, slate, sintered fly ash, or any natural lightweight aggregate meeting ASTM C 330 and possessing equivalent fire-resistance properties and natural sand. Its unit weight is generally between 105 and 120 pcf (1680 and 1920 kg/m^3).

CONCRETE, SILICEOUS AGGREGATE. Concrete made with normal-weight aggregates consisting mainly of silica or compounds other than calcium or magnesium carbonate, which contains more than 40% quartz, chert, or flint.

CONCRETE, VERMICULITE. A lightweight insulating concrete made with vermiculite concrete aggregate which is laminated micaceous material produced by expanding the ore at high temperatures. When added to a portland cement slurry the resulting concrete has a dry unit weight of approximately 30 pcf (480 kg/m^3).

GLASS FIBERBOARD. Fibrous glass roof insulation consisting of inorganic glass fibers formed into rigid boards using a binder. The board has a top surface faced with asphalt and kraft reinforced with glass fiber.

MINERAL BOARD. A rigid felted thermal insulation board consisting of either felted mineral fiber or cellular beads of expanded aggregate formed into flat rectangular units.

721.2 Concrete Assemblies. The provisions of 780CMR 721.2 contain procedures by which the fire-resistance ratings of concrete assemblies are established by calculations.

721.2.1 Concrete Walls. Cast-in-place and precast concrete walls shall comply with 780 CMR 721.2.1.1. Multiwythe concrete walls shall comply with 780 CMR 721.2.1.2. Joints between precast panels shall comply with 780 CMR 721.2.1.3. Concrete walls with gypsum wallboard or plaster finish shall comply with 780 CMR 721.2.1.4.

721.2.1.1 Cast-in-place or Precast Walls. The minimum equivalent thicknesses of cast-in-place or precast concrete walls for fire-resistance ratings of one hour to four hours are shown in Table 721.2.1.1. For solid walls with flat vertical surfaces, the equivalent thickness is the same as the actual thickness. The values in Table 721.2.1.1 apply to plain, reinforced or prestressed concrete walls.

TABLE 721.2.1.1
MINIMUM EQUIVALENT THICKNESS OF CAST-IN-PLACE OR PRECAST CONCRETE WALLS, LOAD-BEARING OR NONLOAD-BEARING

CONCRETE TYPE	MINIMUM SLAB THICKNESS (inches) FOR FIRE-RESISTANCE RATING OF				
	1-hour	1½-hour	2-hour	3-hour	4-hour
Siliceous	3.5	4.3	5	6.2	7
Carbonate	3.2	4	4.6	5.7	6.6
Sand-Lightweight	2.7	3.3	3.8	4.6	5.4
Lightweight	2.5	3.1	3.6	4.4	5.1

For SI: 1 inch = 25.4 mm.

721.2.1.1.1 Hollow-core Precast Wall Panels. For hollow-core precast concrete wall panels in which the cores are of constant cross section throughout the length, calculation of the equivalent thickness by dividing the net cross-sectional area (the gross cross section minus the area of the cores) of the panel by its width shall be permitted.

721.2.1.1.2 Core Spaces Filled. Where all of the core spaces of hollow-core wall panels are filled with loose-fill material, such as expanded shale, clay, or slag, or vermiculite or perlite, the fire-resistance rating of the wall is the same as that of a solid wall of the same concrete type and of the same overall thickness.

721.2.1.1.3 Tapered Cross Sections. The thickness of panels with tapered cross sections shall be that determined at a distance $2t$ or six inches (152 mm), whichever is less, from the point of minimum thickness, where t is the minimum thickness.

721.2.1.1.4 Ribbed or Undulating Surfaces. The equivalent thickness of panels with ribbed or undulating surfaces shall be determined by one of the following expressions:

For s ³ $4t$, the thickness to be used shall be t
For s £ $2t$, the thickness to be used shall be te
For $4t >> s >> 2t$, the thickness to be used shall be

Equation 7-3

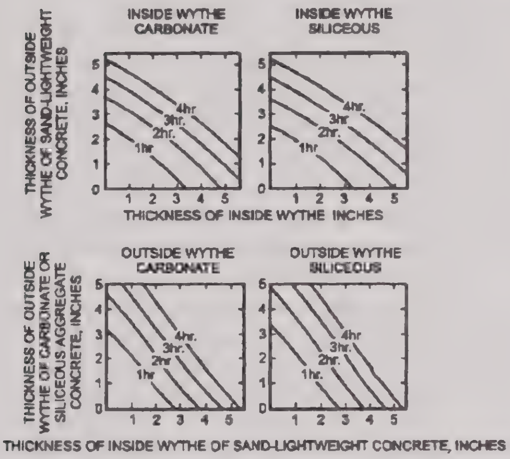
$$t + \left(\frac{4t}{s} - 1\right)\left(t_e - t\right)$$

where:

s = Spacing of ribs or undulations.
t = Minimum thickness.
t_e = Equivalent thickness of the panel calculated as the net cross-sectional area of the panel divided by the width, in which the maximum thickness used in the calculation shall not exceed $2t$.

721.2.1.2 Multiwythe Walls. For walls that consist of two wythes of different types of concrete, the fire-resistance ratings shall be permitted to be determined from Figure 721.2.1.2.

Figure 721.2.1.2
FIRE-RESISTANCE RATINGS OF TWO-WYTHE CONCRETE WALLS



721.2.1.2.1 Two or More Wythes. The fire-resistance rating for wall panels consisting of two or more wythes shall be permitted to be determined by the formula:

Equation 7-4

$$R = (R_1^{0.59} + R_2^{0.59} + \ldots + R_a^{0.59})^{1.7}$$

where:

R = The fire endurance of the assembly, minutes.

R_1, R_n = The fire endurances of the individual wythes, minutes. Values of $R_n^{0.59}$ for use in Equation 7-4 are given in Table 721.2.1.2(1). Calculated fire-resistance ratings are shown in Table 721.2.1.2(2).

721.2.1.2.2 Foam Plastic Insulation. The fire-resistance ratings of precast concrete wall panels consisting of a layer of foam plastic insulation sandwiched between two wythes of concrete shall be permitted to be determined by use of Equation 7-4. Foam plastic insulation with a total thickness of less than one inch (25 mm) shall be disregarded. The *Rn* value for thickness of foam plastic insulation of one inch (25 mm) or greater, for use in the calculation, is five minutes; therefore $R_n^{0.59} = 2.5$.

TABLE 721.2.1.2(1)
VALUES OF Rn0.59 FOR USE IN EQUATION 7-4

TYPE OF MATERIAL	THICKNESS OF MATERIAL (inches)											
	1½	2	2½	3	3½	4	4½	5	5½	6	6½	7
Siliceous aggregate concrete	5.3	6.5	8.1	9.5	11.3	13	14.9	16.9	18.8	20.7	22.8	25.1
Carbonate aggregate concrete	5.5	7.1	8.9	10.4	12	14	16.2	18.1	20.3	21.9	24.7	27.2[c]
Sand-lightweight concrete	6.5	8.2	10.5	12.8	15.5	18.1	20.7	23.3	26.0[c]	Note c	Note c	Note c
Lightweight concrete	6.6	8.8	11.2	13.7	16.5	19.1	21.9	24.7	27.8[c]	Note c	Note c	Note c
Insulating concrete[a]	9.3	13.3	16.6	18.3	23.1	26.5[c]	Note c	Note c	Note c	Note c	Note c	Note c
Airspaceb	—	—	—	—	—	—	—	—	—	—	—	—

For SI: 1 inch = 25.4 mm, 1 pound per cubic foot = 16.02 kg/m³.

a. Dry unit weight of 35 pcf or less and consisting of cellular, perlite or vermiculite concrete.

b. The $R_n^{0.59}$ value for one ½" to 3½" airspace is 3.3. The $R_n^{0.59}$ value for two ½" to 3½" airspaces is 6.7.

c. The fire-resistance rating for this thickness exceeds four hours.

TABLE 721.2.1.2(2)
FIRE-RESISTANCE RATINGS BASED ON $R^{0.59}$

R^a, MINUTES	$R^{0.59}$
60	11.2
120	16.85
180	21.41
240	25.37

721.2.1.3 Joints Between Precast Wall Panels. Joints between precast concrete wall panels which are not insulated as required by 780 CMR 721.2 shall be considered as openings in walls. Uninsulated joints shall be included in determining the percentage of openings permitted by Table 704.8. Where openings are not permitted or are required by 780 CMR to be protected, the provisions of 780 CMR 721.2 shall be used to determine the amount of joint insulation required. Insulated joints shall not be considered openings for purposes of determining compliance with the allowable percentage of openings in Table 704.8.

721.2.1.3.1 Ceramic Fiber Joint Protection. Figure 721.2.1.3.1 shows thicknesses of ceramic fiber blankets to be used to insulate joints between precast concrete wall panels for various panel thicknesses and for joint widths of ⅜ inch (9.5 mm) and one inch (25 mm) for fire-resistance ratings of one hour to four hours. For joint widths between ⅜ inch (9.5 mm) and one inch (25 mm), the thickness of ceramic fiber blanket is allowed to be determined by direct interpolation. Other tested and labeled materials are acceptable in place of ceramic fiber blankets.

721.2.1.4 Walls with Gypsum Wallboard or Plaster Finishes. The fire-resistance rating of cast-in-place or precast concrete walls with finishes of gypsum wallboard or plaster applied to one or both sides shall be permitted to be calculated in accordance with the provisions of 780 CMR 721.2.

721.2.1.4.1 Nonfire-exposed Side. Where the finish of gypsum wallboard or plaster is applied to the side of the wall not exposed to fire, the contribution of the finish to the total fire-resistance rating shall be determined as follows: The thickness of the finish shall first be corrected by multiplying the actual thickness of the finish by the applicable factor determined from Table 721.2.1.4(1) based on the type of aggregate in the concrete. The corrected thickness of finish shall then be added to the actual or equivalent thickness of concrete and fire-resistance rating of the concrete and finish determined from Table 721.2.1.1, Figure 721.2.1.2 or Table 721.2.1.2(1).

Figure 721.2.1.3.1
CERAMIC FIBER JOINT PROTECTION

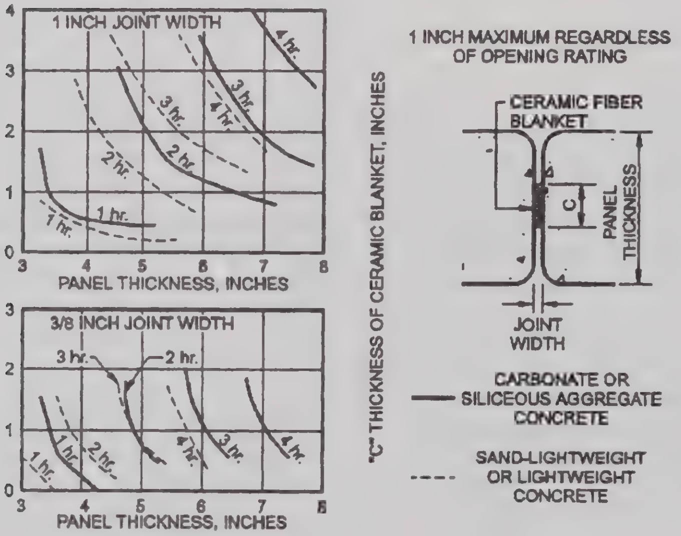


TABLE 721.2.1.4(1)
MULTIPLYING FACTOR FOR FINISHES ON NONFIRE-EXPOSED SIDE OF WALL

	TYPE OF AGGREGATE USED IN CONCRETE OR CONCRETE MASONRY			
TYPE OF FINISH APPLIED TO MASONRY WALL	**Concrete: siliceous or carbonate Masonry: siliceous or calcareous gravel**	**Concrete: sand lightweight concrete Masonry: limestone, cinders or unexpected slag**	**Concrete: lightweight concrete Masonry: expanded shale, clay or slate**	**Concrete: pumice, or expanded slag**
Portland cement-sand plaster	1	0.75[a]	0.75[a]	0.50[a]
Gypsum-sand plaster or gypsum wallboard	1.25	1	1	1
Gypsum-vermiculite or perlite plaster	1.75	1.5	1.5	1.25

For SI: one inch = 25.4 mm.

a. For portland cement-sand plaster ⅝ inch or less in thickness and applied directly to the masonry on the nonfire-exposed side of the wall, the multiplying factor shall be 1.00.

721.2.1.4.2 Fire-exposed Side. Where gypsum wallboard or plaster is applied to the fire-exposed side of the wall, the contribution of the finish to the total fire-resistance rating shall be determined as follows: The time assigned to the finish as established by Table 721.2.1.4(2) shall be added to the fire-resistance rating determined from Table 721.2.1.1 or Figure 721.2.1.2, or Table 721.2.1.2(1) for the concrete alone, or to the rating determined in 780 CMR 721.2.1.4.1 for the concrete and finish on the nonfire-exposed side.

721.2.1.4.3 Nonsymmetrical Assemblies. For a wall having no finish on one side or different types or thicknesses of finish on each side, the calculation procedures of 780 CMR 721.2.1.4.1 and 721.2.1.4.2 shall be performed twice, assuming either side of the wall to be the fire-exposed side. The fire-restance rating of the wall shall not exceed the lower of the two values.

Exception. For an exterior wall with more than five feet (1524 mm) of horizontal separation, the fire shall be assumed to occur on the interior side only.

721.2.1.4.4 Minimum Concrete Fire-resistance Rating. Where finishes applied to one or both sides of a concrete wall contribute to the fire-resistance rating, the concrete alone shall provide not less than one-half of the total required fire-resistance rating. Additionally, the contribution to the fire resistance of the finish on the nonfire-exposed side of a load-bearing wall shall not exceed one-half the contribution of the concrete alone.

TABLE 721.2.1.4(2)
TIME ASSIGNED TO FINISH MATERIALS ON FIRE-EXPOSED SIDE OF WALL

FINISH DESCRIPTION	**TIME (minute)**
Gypsum wallboard	
⅜ inch	10
½ inch	15
⅝ inch	20
2 layers of ⅜ inch	25
1 layer ⅜ inch, 1 layer ½ inch	35
2 layers ½ inch	40
Type X gypsum wallboard	
½ inch	25
⅝ inch	40
Portland cement-sand plaster applied directly to concrete masonry	See Note a
Portland cement-sand plaster on metal lath	
¾ inch	20
⅞ inch	25
1 inch	30
Gypsum sand plaster on ⅜-inch gypsum lath	
½ inch	35
⅝ inch	40
¾ inch	50
Gypsum sand plaster on metal lath	
¾ inch	50
⅞ inch	60
1 inch	80

For SI: 1 inch = 25.4 mm.

a. The actual thickness of portland cement-sand plaster, provided it is ⅝ inch or less in thickness, shall be permitted to be included in determining the equivalent thickness of the masonry for use in Table 721.3.2.

721.2.1.4.5 Concrete Finishes. Finishes on concrete walls that are assumed to contribute to the total fire-resistance rating of the wall shall comply with the installation requirements of 780 CMR 721.3.2.5.

721.2.2 Concrete Floor and Roof Slabs. Reinforced and prestressed floors and roofs shall comply with 780 CMR 721.2.2.1. Multicourse floors and roofs shall comply with 780 CMR 721.2.2.2 and 721.2.2.3, respectively.

721.2.2.1 Reinforced and Prestressed Floors and Roofs. The minimum thicknesses of reinforced and prestressed concrete floor or roof slabs for fire-resistance ratings of one hour to four hours are shown in Table 721.2.2.1.

TABLE 721.2.2.1
MINIMUM SLAB THICKNESS (inches)

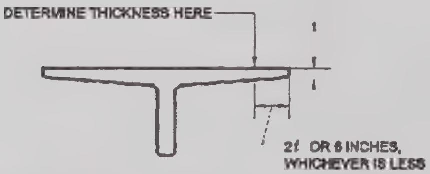
CONCRETE TYPE	FIRE-RESISTANCE RATING (hour)				
	1	1½	2	3	4
Siliceous	3.5	4.3	5	6.2	7
Carbonate	3.2	4	4.6	5.7	6.6
Sand-lightweight	2.7	3.3	3.8	4.6	5.4
Lightweight	2.5	3.1	3.6	4.4	5.1

For SI: 1 inch = 25.4 mm.

721.2.2.1.1 Hollow-core Prestressed Slabs. For hollow-core prestressed concrete slabs in which the cores are of constant cross section throughout the length, the equivalent thickness shall be permitted to be obtained by dividing the net cross-sectional area of the slab including grout in the joints, by its width.

721.2.2.1.2 Slabs with Sloping Soffits. The thickness of slabs with sloping soffits (see Figure 721.2.2.1.2) shall be determined at a distance $2t$ or six inches (152 mm), whichever is less, from the point of minimum thickness, where t is the minimum thickness.

Figure 721.2.2.1.2
DETERMINATION OF SLAB THICKNESS FOR SLOPING SOFFITS



For SI: 1 inch = 25.4 mm.

721.2.2.1.3 Slabs with Ribbed Soffits. The thickness of slabs with ribbed or undulating soffits (see Figure 721.2.2.1.3) shall be determined by one of the following expressions, whichever is applicable:

For $s \geq 4t$, the thickness to be used shall be t
For $s \leq 2t$, the thickness to be used shall be t_e
For $4t >> s >> 2t$, the thickness to be used shall be

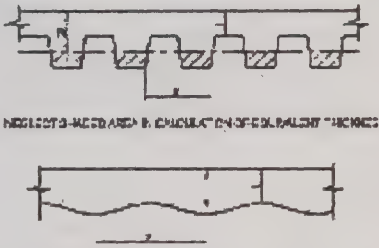
Equation 7-5

$$t + \left(\frac{4t}{s} - 1\right)\left(t_e - t\right)$$

where:

s = Spacing of ribs or undulations.
t = Minimum thickness.
t_e = Equivalent thickness of the slab calculated as the net area of the slab divided by the width, in which the maximum thickness used in the calculation shall not exceed $2t$.

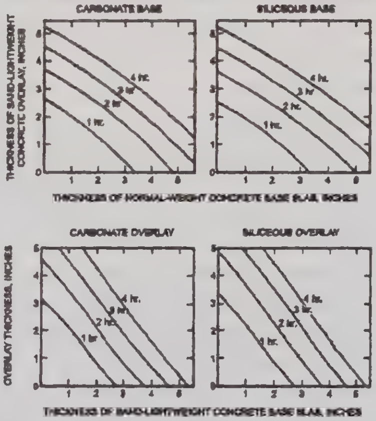
Figure 721.2.2.1.3
SLABS WITH RIBBED OR UNDULATING SOFFITS



For SI: 1 inch = 25.4 mm.

721.2.2.2 Multicourse Floors. The fire-resistance ratings of floors that consist of a base slab of concrete with a topping (overlay) of a different type of concrete shall comply with Figure 721.2.2.2.

Figure 721.2.2.2
FIRE-RESISTANCE RATINGS FOR TWO-COURSE CONCRETE FLOORS

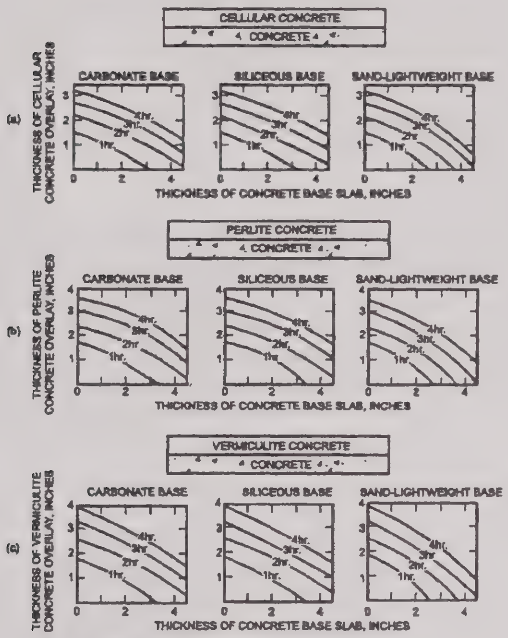


For SI: 1 inch = 25.4 mm.

721.2.2.3 Multicourse Roofs. The fire-resistance ratings of roofs which consist of a base slab of concrete with a topping (overlay) of an insulating concrete or with an insulating board and built-up roofing shall comply with Figures 721.2.2.3(1) and 721.2.2.3(2).

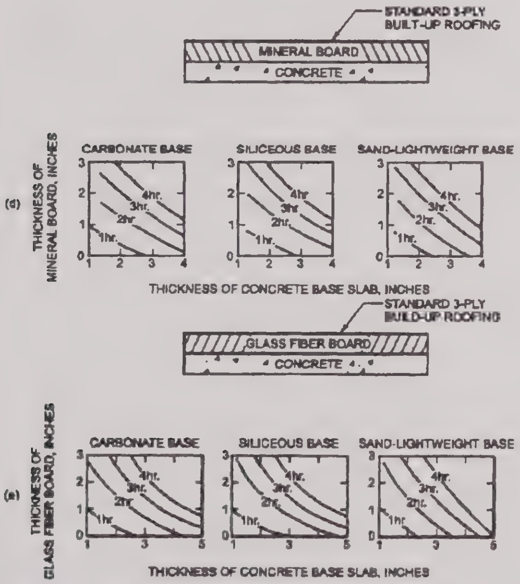
721.2.2.3.1 Heat Transfer. For the transfer of heat, three-ply built-up roofing contributes ten minutes to the fire-resistance rating. The fire-resistance rating for concrete assemblies such as those shown in Figure 721.2.2.3(1) shall be increased by ten minutes. This increase is not applicable to those shown in Figure 721.2.2.3(2).

Figure 721.2.2.3(1)
FIRE-RESISTANCE RATINGS FOR CONCRETE ROOF ASSEMBLIES



For SI: 1 inch = 25.4 mm.

Figure 721.2.2.3(2)
FIRE-RESISTANCE RATINGS FOR CONCRETE ROOF ASSEMBLIES



For SI: 1 inch = 25.4 mm.

721.2.2.4 Joints in Precast Slabs. Joints between adjacent precast concrete slabs need not be considered in calculating the slab thickness provided that a concrete topping at least one inch (25 mm) thick is used. Where no concrete topping is used, joints must be grouted to a depth of at least one-third the slab thickness at the joint, but not less than one inch (25 mm), or the joints must be made fire resistant by other approved methods.

721.2.3 Concrete Cover over Reinforcement. The minimum thickness of concrete cover over reinforcement in concrete slabs, reinforced beams and prestressed beams shall comply with 780 CMR 721.2.3.

721.2.3.1 Slab Cover. The minimum thickness of concrete cover to the positive moment reinforcement shall comply with Table 721.2.3(1) for reinforced concrete and Table 721.2.3(2) for prestressed concrete. These tables are applicable for solid or hollow-core one-way or two-way slabs with flat undersurfaces. These tables are applicable to slabs that are either cast in place or precast. For precast prestressed concrete not covered elsewhere, the procedures contained in PCI MNL 124 shall be acceptable.

721.2.3.2 Reinforced Beam Cover. The minimum thickness of concrete cover to the positive moment reinforcement (bottom steel) for reinforced concrete beams is shown in Table 721.2.3(3) for fire-resistance ratings of one hour to four hours.

721.2.3.3 Prestressed Beam Cover. The minimum thickness of concrete cover to the positive moment prestressing tendons (bottom steel) for restrained and unrestrained prestressed concrete beams and stemmed units shall comply with the values shown in Tables 721.2.3(4) and 721.2.3(5) for fire-resistance ratings of one hour to four hours. Values in Table 721.2.3(4) apply to beams eight inches (203 mm) or greater in width. Values in Table 721.2.3(5) apply to beams or stems of any width, provided the cross-section area is not less than 40 square inches (25 806 mm^2). In case of differences between the values determined from Table 721.2.3(4) or 721.2.3(5), it is permitted to use the smaller value. The concrete cover shall be calculated in accordance with 780 CMR 721.2.3.3.1. The minimum concrete cover for nonprestressed reinforcement in prestressed concrete beams shall comply with 780 CMR 721.2.3.2.

TABLE 721.2.3(1)
COVER THICKNESS FOR REINFORCED CONCRETE FLOOR OR ROOF SLABS (inches)

CONCRETE AGGREGATE TYPE	FIRE-RESISTANCE RATING (hours)									
	Restrained					Unrestrained				
	1	1½	2	3	4	1	1½	2	3	4
Siliceous	¾	¾	¾	¾	¾	¾	¾	1	1¼	1⅝
Carbonate	¾	¾	¾	¾	¾	¾	¾	¾	1¼	1¼
Sand-lightweight or lightweight	¾	¾	¾	¾	¾	¾	¾	¾	1¼	1¼

For SI: 1 inch = 25.4 mm.

TABLE 721.2.3(2)
COVER THICKNESS FOR REINFORCED CONCRETE FLOOR OR ROOF SLABS (inches)

CONCRETE AGGREGATE TYPE	FIRE-RESISTANCE RATING (hours)									
	Restrained					Unrestrained				
	1	1½	2	3	4	1	1½	2	3	4
Siliceous	¾	¾	¾	¾	¾	1⅛	1½	1¾	2⅜	2¾
Carbonate	¾	¾	¾	¾	¾	1	1⅜	1⅝	2⅛	2¼
Sand-lightweight or lightweight	¾	¾	¾	¾	¾	1	1⅜	1½	2	2¼

For SI: 1 inch = 25.4 mm.

TABLE 721.2.3(3)
MINIMUM COVER FOR MAIN REINFORCING BARS OF REINFORCED CONCRETE BEAMS (APPLICABLE TO ALL TYPES OF STRUCTURAL CONCRETE)

RESTRAINED OR UNRESTRAINED[a]	BEAM WIDTH[b] (inches)	FIRE-RESISTANCE RATING (hours)				
		1	1½	2	3	4
Restrained	5	¾	¾	¾	1[a]	1¼[a]
	7	¾	¾	¾	¾	¾
	≥ 10	¾	¾	¾	¾	¾
Unrestrained	5	3/4	1	1¼	—	—
	7	¾	¾	¾	1¾	3
	≥ 10	¾	¾	¾	1	1¾

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

a. Tabulated values for restrained assemblies apply to beams spaced more than 4 feet on center. For restrained beams spaced four feet or less on center, minimum cover of ¾ inch is adequate for ratings of four hours or less.

b. For beam widths between the tabulated values, the minimum cover thickness can be determined by direct interpolation.

c. The cover for an individual reinforcing bar is the minimum thickness of concrete between the surface of the bar and the fire-exposed surface of the beam. For beams in which several bars are used, the cover for corner bars used in the calculation shall be reduced to one-half of the actual value. The cover for an individual bar must be not less than one-half of the value given in Table 721.2.3(3) nor less than ¾ inch.

TABLE 721.2.3(4)
MINIMUM COVER FOR PRESTRESSED CONCRETE BEAMS EIGHT INCHES OR GREATER IN WIDTH

RESTRAINED OR UNRESTRAINED[a]	CONCRETE AGGREGATE TYPE	BEAM WIDTH[b] (inches)	FIRE-RESISTANCE RATING (hours)				
			1	1½	2	3	4
Restrained	Carbonate or siliceous	8	1½	1½	1½	1¾[a]	2½[a]
	Carbonate or siliceous	≥ 12	1½	1½	1½	1½	1⅞[a]
	Sand lightweight	8	1½	1½	1½	1½	2[a]
	Sand lightweight	≥ 12	1½	1½	1½	1½	1⅝[a]
Unrestrained	Carbonate or siliceous	8	1½	1¾	2½	5[c]	—
	Carbonate or siliceous	≥ 12	1½	1½	1⅞[a]	2½	3
	Sand lightweight	8	1½	1½	2	3¼	—
	Sand lightweight	≥ 12	1½	1½	1⅝	2	2½

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

a. Tabulated values for restrained assemblies apply to beams spaced more than 4 feet on center. For restrained beams spaced 4 feet or less on center, minimum cover of ¾ inch is adequate for 4-hour ratings or less.

b. For beam widths between eight inches and 12 inches, minimum cover thickness can be determined by direct interpolation.

c. Not practical for eight-inch-wide beam but shown for purposes of interpolation.

TABLE 721.2.3(5)
MINIMUM COVER FOR PRESTRESSED CONCRETE BEAMS OF ALL WIDTHS

RESTRAINED OR UNRESTRAINED[a]	CONCRETE AGGREGATE TYPE	BEAM AREA[b] A (square inches)	FIRE-RESISTANCE RATING (hours)				
			1	1½	2	3	4
Restrained	All	40 ≤A ≤ 150	1½	1½	2	2½	—
	Carbonate or siliceous	150 < A ≤ 300	1½	1½	1½	1¾	2½
		300 < ½A	1½	1½	1½	1½	2
	Sand lightweight	150 < A	1½	1½	1½	1½	2
Unrestrained	All	40 ≤ A ≤ 150	2	2½	—	—	—
	Carbonate or siliceous	150 < A ≤300	1½	1¾	2½	—	—
		300 < A	1½	1½	2	3[c]	4[c]
	Sand lightweight	150 < A	1½	1½	2	3[c]	4[c]

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

a. Tabulated values for restrained assemblies apply to beams spaced more than four feet on center. For restrained beams spaced 4 feet or less on center, minimum cover of ¾ inch is adequate for four-hour ratings or less.

b. The cross-sectional area of a stem is permitted to include a portion of the area in the flange, provided the width of the flange used in the calculation does not exceed three times the average width of the stem.

c. U-shaped or hooped stirrups spaced not to exceed the depth of the member and having a minimum cover of one inch shall be provided.

721.2.3.3.1 Calculating Concrete Cover. The concrete cover for an individual tendon is the minimum thickness of concrete between the surface of the tendon and the fire-exposed surface of the beam, except that for ungrouped ducts, the assumed cover thickness is the minimum thickness of concrete between the surface of the duct and the fire-exposed surface of the beam. For beams in which two or more tendons are used, the cover is assumed to be the average of the minimum cover of the individual tendons. For corner tendons (tendons equal distance from the bottom and side), the minimum cover used in the calculation shall be one-half the actual value. For stemmed members with two or more prestressing tendons located along the vertical centerline of the stem, the average cover shall be the distance from the bottom of the member to the centroid of the tendons. The actual cover for any individual tendon shall not be less than one-half the smaller value shown in Tables 721.2.3(4) and 721.2.3(5), or one inch (25 mm), whichever is greater.

721.2.4 Concrete Columns. Concrete columns shall comply with 780CMR 721.2.4.

TABLE 721.2.4
MINIMUM DIMENSION OF CONCRETE COLUMNS (inches)

TYPES OF CONCRETE	FIRE-RESISTANCE RATING (hours)				
	1	1½	2[a]	3[a]	4[b]
Siliceous	8	9	10	12	14
Carbonate	8	9	10	11	12
Sand-lightweight	8	8½	9	10½	12

For SI: 1 inch = 25 mm.

a. The minimum dimension is permitted to be reduced to eight inches for rectangular columns with two parallel sides at least 36 inches in length.

b. The minimum dimension is permitted to be reduced to ten inches for rectangular columns with two parallel sides at least 36 inches in length.

721.2.4.1 Minimum Size. The minimum overall dimensions of reinforced concrete columns for fire-resistance ratings of one hour to four hours shall comply with Table 721.2.4.

721.2.4.2 Minimum Cover for R/C Columns. The minimum thickness of concrete cover to the main longitudinal reinforcement in columns, regardless of the type of aggregate used in the concrete, shall not be less than one inch (25 mm) times the number of hours of required fire resistance or two inches (51 mm), whichever is less.

721.2.4.3 Columns Built into Walls. The minimum dimensions of Table 721.2.4 do not apply to a reinforced concrete column that is built into a concrete or masonry wall provided all of the following are met:

1. The fire-resistance rating for the wall is equal to or greater than the required rating of the column;
2. The main longitudinal reinforcing in the column has cover not less than that required by 780 CMR 721.2.4.2; and
3. Openings in the wall are protected in accordance with Table 715.4.

Where openings in the wall are not protected as required by 780 CMR 715.4, the minimum dimension of columns required to have a fire-resistance rating of three hours or less shall be eight inches (203 mm), and ten inches (254 mm) for columns required to have a fire-resistance rating of four hours, regardless of the type of aggregate used in the concrete.

721.2.4.4 Precast Cover Units for Steel Columns. See 780 CMR 721.5.1.4.

721.3 Concrete Masonry. The provisions of 780 CMR 721.3 contain procedures by which the fire-resistance ratings of concrete masonry are established by calculations.

721.3.1 Equivalent Thickness. The equivalent thickness of concrete masonry construction shall be determined in accordance with the provisions of 780 CMR 721.3.1.

721.3.1.1 Concrete Masonry Unit plus Finishes. The equivalent thickness of concrete masonry assemblies, Tea, shall be computed as the sum of the equivalent thickness of the concrete masonry unit, Te, as determined by 780 CMR 721.3.1.2, 721.3.1.3, or 721.3.1.4, plus the equivalent thickness of finishes, Tef, determined in accordance with 780 CMR 721.3.2:

Equation 7-6

$$T_{ea} = T_e + T_{ef}$$

$$T_e = V_n/LH$$

where:

V_n = Net volume of masonry unit (inch^3) (mm^3).

L = Specified length of masonry unit (inch) (mm).

H = Specified height of masonry unit (inch) (mm).

721.3.1.2 Ungrouted or Partially Grouted Construction. Te shall be the value obtained for the concrete masonry unit determined in accordance with ASTM C 140.

721.3.1.3 Solid Grouted Construction. The equivalent thickness, Te, of solid grouted concrete masonry units is the actual thickness of the unit.

721.3.1.4 Airspaces and Cells Filled with Loose-fill Material. The equivalent thickness of completely filled hollow concrete masonry is the actual thickness of the unit when loose-fill materials are: sand, pea gravel, crushed stone, or slag that meet ASTM C 33 requirements; pumice, scoria, expanded shale, expanded clay, expanded slate, expanded slag, expanded fly ash, or cinders that comply with ASTM C 331; or perlite or vermiculite meeting the requirements of ASTM C 549 and ASTM C 516, respectively.

721.3.2 Concrete Masonry Walls. The fire-resistance rating of walls and partitions constructed of concrete masonry units shall be determined from Table 721.3.2. The rating shall be based on the equivalent thickness of the masonry and type of aggregate used.

721.3.2.1 Finish on Nonfire-exposed Side. Where plaster or gypsum wallboard is applied to the side of the wall not exposed to fire, the contribution of the finish to the total fire-resistance rating shall be determined as follows: The thickness of gypsum wallboard or plaster shall be corrected by multiplying the actual thickness of the finish by applicable factor determined from Table 721.2.1.4(1). This corrected thickness of finish shall be added to the equivalent thickness of masonry and the fire-resistance rating of the masonry and finish determined from Table 721.3.2.

TABLE 721.3.2
MINIMUM EQUIVALENT THICKNESS (inches) OF BEARING OR NONBEARING CONCRETE MASONRY WALLS[a, b, c, d]

TYPE OF AGGREGATE	FIRE-RESISTANCE RATING (hours)														
	½	¾	1	1¼	1 ½	1¾	2	2¼	2 ½	2¾	3	3¼	3 ½	3¾	4
Pumice or expanded slag	1.5	1.9	2.1	2.5	2.7	3	3.2	3.4	3.6	3.8	4	4.2	4.4	4.5	4.7
Expanded shale, clay or slate	1.8	2.2	2.6	2.9	3.3	3.4	3.6	3.8	4	4.2	4.4	4.6	4.8	4.9	5.1
Limestone, cinders or unexpanded slag	1.9	2.3	2.7	3.1	3.4	3.7	4	4.3	4.5	4.8	5	5.2	5.5	5.7	5.9
Calcareous or siliceous gravel	2	2.4	2.8	3.2	3.6	3.9	4.2	4.5	4.8	5	5.3	5.5	5.8	6	6.2

For SI: 1 inch = 25.4 mm.

a. Values between those shown in the table can be determined by direct interpolation.

b. Where combustible members are framed into the wall, the thickness of solid material between the end of each member and the opposite face of the wall, or between members set in from opposite sides, shall not be less than 93% of the thickness shown in the table.

c. Requirements of ASTM C 55, ASTM C 73 or ASTM C 90 shall apply.

d. Minimum required equivalent thickness corresponding to the hourly fire-resistance rating for units with a combination of aggregate shall be determined by linear interpolation based on the percent by volume of each aggregate used in manufacture.

721.3.2.2 Finish on Fire-exposed Side. Where plaster or gypsum wallboard is applied to the fire-exposed side of the wall, the contribution of the finish to the total fire-resistance rating shall be determined as follows: The time assigned to the finish as established by Table 721.2.1.4(2) shall be added to the fire-resistance rating determined in 780 CMR 721.3.2 for the masonry alone, or in 780 CMR 721.3.2.1 for the masonry and finish on the nonfire-exposed side.

721.3.2.3 Nonsymmetrical Assemblies. For a wall having no finish on one side or having different types or thicknesses of finish on each side, the calculation procedures of 780 CMR 721.3.2 shall be performed twice, assuming either side of the wall to be the fire-exposed side. The fire-resistance rating of the wall shall not exceed the lower of the two values calculated.

Exception: For exterior walls with more than five feet (1524 mm) of horizontal separation, the fire shall be assumed to occur on the interior side only.

721.3.2.4 Minimum Concrete Masonry Fire-resistance Rating. Where the finish applied to a concrete masonry wall contributes to its fire-resistance rating, the masonry alone shall provide not less than one-half the total required fire-resistance rating.

721.3.2.5 Attachment of Finishes. Installation of finishes shall be as follows:

1. Gypsum wallboard and gypsum lath applied to concrete masonry or concrete walls shall be secured to wood or steel furring members spaced not more than 16 inches (406 mm) on center (o.c.).
2. Gypsum wallboard shall be installed with the long dimension parallel to the furring members and shall have all joints finished.
3. Other aspects of the installation of finishes shall comply with the applicable provisions of 780 CMR 7.00 and 25.00.

721.3.3 Multiwythe Masonry Walls. The fire-resistance rating of wall assemblies constructed of multiple wythes of masonry materials shall be permitted to be based on the fire-resistance rating period of each wythe and the continuous airspace between each wythe in accordance with the following formula:

Equation 7-7

$$R_A = (R_1^{0.59} + R_2^{0.59} + \ldots + R_n + A_1 + A_2 + \ldots + A_n)^{1.7}$$

where:

R_A = Fire endurance rating of the assembly (hours).

$R_1, R_2, \ldots, R_n$ = Fire endurance rating of wythes for 1, 2, *n* (hours), respectively.

$A_1, A_2, \ldots, A_n$ = 0.30, factor for each continuous airspace for 1, 2, ...*n*, respectively, having a depth of ½ inch (12.7 mm) or more between wythes.

721.3.4 Concrete Masonry Lintels. Fire-resistance ratings for concrete masonry lintels shall be determined based upon the nominal thickness of the lintel and the minimum thickness of concrete masonry or concrete, or any combination thereof, covering the main reinforcing bars, as determined according to Table 721.3.4, or by approved alternate methods.

TABLE 721.3.4
MINIMUM COVER OF LONGITUDINAL REINFORCEMENT IN FIRE-RESISTANCE-RATED REINFORCED CONCRETE MASONRY LINTELS (inches)

NOMINAL WIDTH OF LINTEL (inches)	FIRE-RESISTANCE RATING (hours)			
	1	2	3	4
6	1½	2	—	—
8	1½	1½	1¾	3
10 or greater	1½	1½	1½	1¾

For SI: 1 inch = 25.4 mm.

721.3.5 Concrete Masonry Columns. The fire-resistance rating of concrete masonry columns shall be determined based upon the least plan dimension of the column in accordance with Table 721.3.5 or by approved alternate methods.

TABLE 721.3.5
MINIMUM DIMENSION OF CONCRETE MASONRY COLUMNS (inches)

FIRE-RESISTANCE RATING (hours)			
1	2	3	4
8	10	12	14

For SI: 1 inch = 25.4 mm.

721.4 Clay Brick and Tile Masonry. The provisions of 780 CMR 721.4 contain procedures by which the fire-resistance ratings of clay brick and tile masonry are established by calculations.

721.4.1 Masonry Walls. The fire-resistance rating of masonry walls shall be based upon the equivalent thickness as calculated in accordance with 780 CMR 721.4.1. The calculation shall take into account finishes applied to the wall and airspaces between wythes in multiwythe construction.

721.4.1.1 Equivalent Thickness. The fire-resistance ratings of walls or partitions constructed of solid or hollow clay masonry units shall be determined from Table 721.4.1(1) or 721.4.1(2). The equivalent thickness of the clay masonry unit shall be determined by Equation 7-8 when using Table 721.4.1(1). The fire-resistance rating determined from Table 721.4.1(1) shall be permitted to be used in the calculated fire-resistance rating procedure in 780 CMR 721.4.2.

Equation 7-8

$$T_e = V_n/LH$$

where:

T_e = The equivalent thickness of the clay masonry unit (inches).

V_n = The net volume of the clay masonry unit (inch^3).

L = The specified length of the clay masonry unit (inches).

H = The specified height of the clay masonry unit (inches).

TABLE 721.4.1(1)
FIRE-RESISTANCE PERIODS OF CLAY MASONRY WALLS

MATERIAL TYPE	MINIMUM REQUIRED EQUIVALENT THICKNESS FOR FIRE RESISTANCE[a],[b],[c] (inches)			
	1 hour	2 hour	3 hour	4 hour
Solid brick of clay or shale[d]	2.7	3.8	4.9	6
Hollow brick or tile of clay or shale, unfilled	2.3	3.4	4.3	5
Hollow brick or tile of clay or shale, grouted or filled with materials specified in 780 CMR 721.4.1.1.3	3	4.4	5.5	6.6

For SI: 1 inch = 25.4 mm.

a. Equivalent thickness as determined from 780 CMR 721.4.1.1.

b. Calculated fire resistance between the hourly increments listed shall be determined by lin ear interpolation.

c. Where combustible members are framed in the wall, the thickness of solid material between the end of each member and the opposite face of the wall, or between members set in from opposite sides, shall not be less than 93% of the thickness shown.

d. For units in which the net cross-sectional area of cored brick in any plane parallel to the sur face containing the cores is at least 75% of the gross cross-sectional area measured in the same plane.

TABLE 721.4.1(2)
FIRE-RESISTANCE RATINGS FOR BEARING STEEL FRAME BRICK VENEER WALLS OR PARTITIONS

WALL OR PARTITION ASSEMBLY	PLASTER SIDE EXPOSED (hours)	BRICK FACED SIDE EXPOSED (hours)
Outside facing of steel studs: ½" wood fiberboard sheathing next to studs, ¾" airspace formed with ¾" x 1⅝" wood strips placed over the fiberboard and secured to the studs; metal or wire lath nailed to such strips, 3¾" brick veneer held in place by filling ¾" airspace between the brick and lath with mortar. Inside facing of studs: ¾" unsanded gypsum plaster on metal or wire lath attached to $^{5}/_{16}$" wood strips secured to edges of the studs.	1.5	4
Outside facing of steel studs: 1" insulation board sheathing attached to studs, 1" airspace, and 3¾" brick veneer attached to steel frame with metal ties every 5th course. Inside facing of studs: ⅞" sanded gypsum plaster (1:2 mix) applied on metal or wire lath attached directly to the studs.	1.5	4
Same as above except use ⅞" vermiculite—gypsum plaster or 1" sanded gypsum plaster (1:2 mix) applied to metal or wire.	2	4
Outside facing of steel studs: ½" gypsum sheathing board, attached to studs, and 3¾" brick veneer attached to steel frame with metal ties every 5th course. Inside facing of studs: ½" sanded gypsum plaster (1:2 mix) applied to ½" perforated gypsum lath securely attached to studs and having strips of metal lath 3" wide applied to all horizontal joints of gypsum lath.	2	4

For SI: 1 inch = 25.4 mm.

721.4.1.1.1 Hollow Clay Units. The equivalent thickness, *Te*, shall be the value obtained for hollow clay units as determined in accordance with ASTM C 67.

721.4.1.1.2 Solid Grouted Clay units. The equivalent thickness of solid grouted clay masonry units shall be taken as the actual thickness of the units.

721.4.1.1.3 Units with Filled Cores. The equivalent thickness of the hollow clay masonry units is the actual thickness of the unit when completely filled with loose-fill materials of: sand, pea gravel, crushed stone, or slag that meet ASTM C 33 requirements; pumice, scoria, expanded shale, expanded clay, expanded slate, expanded slag, expanded fly ash, or cinders in compliance with ASTM C 331; or perlite or vermiculite meeting the requirements of ASTM C 549 and ASTM C 516, respectively.

721.4.1.2 Plaster Finishes. Where plaster is applied to the wall, the total fire-resistance rating shall be determined by the formula:

Equation 7-9

$$R = (R_n^{0.59} + pl)^{1.7}$$

where:

R = The fire endurance of the assembly (hours).

R_n = The fire endurance of the individual wall (hours).

pl = Coefficient for thickness of plaster.

Values for $R_n^{0.59}$ for use in Equation 7-9 are given in Table 721.4.1(3). Coefficients for thickness of plaster shall be selected from Table 721.4.1(4) based on the actual thickness of plaster applied to the wall or partition and whether one or two sides of the wall are plastered.

721.4.1.3 Multiwythe Walls with Airspace. Where a continuous airspace separates multiple wythes of the wall or partition, the total fire-resistance rating shall be determined by the formula:

Equation 7-10

$$R = (R_1^{0.59} + R_2^{0.59} + ... + R_n^{0.59} + as)^{1.7}$$

where:

R = The fire endurance of the assembly (hours).

R_1, R_2 and R_n = The fire endurance of the individual wythes (hours).

as = Coefficient for continuous airspace.

Values for $R_n^{0.59}$ for use in Equation 7-10 are given in Table 721.4.1(3). The coefficient for each continuous air -space of ½ inch to 3½ inches (12.7 to 89 mm) separating two individual wythes shall be 0.3.

721.4.1.4 Nonsymmetrical Assemblies. For a wall having no finish on one side or having different types or thicknesses of finish on each side, the calculation procedures of 780 CMR 721.4.1 shall be performed twice, assuming either side to be the fire-exposed side of the wall. The fire resistance of the wall shall not exceed the lower of the two values determined.

> **Exception:** For exterior walls with more than five feet (1524 mm) of horizontal separation, the fire shall be assumed to occur on the interior side only.

TABLE 721.4.1(3)
VALUES OF $R_n^{0.59}$

R_n	R (hours)
1	1
2	1.5
3	1.91
4	2.27

TABLE 721.4.1(4)
COEFFICIENTS FOR PLASTER, pl^a

THICKNESS OF PLASTER (inch)	ONE SIDE	TWO SIDE
½	0.3	0.6
⅝	0.37	0.75
¾	0.45	0.9

For SI: 1 inch = 25.4 mm.

a. Values listed in table are for 1:3 sanded gypsum plaster.

TABLE 721.4.1(5)
REINFORCED MASONRY LINTELS

NOMINAL LINTEL WIDTH (inches)	MINIMUM LONGITUDINAL REINFORCEMENT COVER FOR FIRE RESISTANCE (inch)			
	1 hour	2 hour	3 hour	4 hour
6	1½	2	NP	NP
8	1½	1½	1¾	3
10 or more	1½	1½	1½	1¾

For SI: 1 inch = 25.4 mm.

NP - Not Permitted

TABLE 721.4.1(6)
REINFORCED CLAY MASONRY COLUMNS

COLUMN SIZE	FIRE-RESISTANCE RATING (hour)			
	1	2	3	4
Minimum column dimension (inches)	8	10	12	14

For SI: 1 inch = 25.4 mm.

721.4.2 Multiwythe Walls. The fire-resistance rating for walls or partitions consisting of two or more dissimilar wythes shall be permitted to be determined by the formula:

Equation 7-11

$$R = (R_1^{0.59} + R_2^{0.59} + ... + R_n^{0.59})^{1.7}$$

where:

R = The fire endurance of the assembly (hours).

R_1, R_2 and R_n = The fire endurance of the individual wythes (hours).

Values for $R_n^{0.59}$ for use in Equation 7-11 are given in Table 721.4.1(3).

721.4.2.1 Multiwythe Walls of Different Material. For walls that consist of two or more wythes of different materials (concrete or concrete masonry units) in combination with clay masonry units, the fire-resistance rating of the different materials shall be permitted to be determined from Table 721.2.1.1 for concrete; Table 721.3.2 for concrete masonry units or Table 721.4.1(1) or 721.4.1(2) for clay and tile masonry units.

721.4.3 Reinforced Clay Masonry Lintels. Fire-resistance ratings for clay masonry lintels shall be determined based on the nominal width of the lintel and the minimum covering for the longitudinal reinforcement in accordance with Table 721.4.1(5).

721.4.4 Reinforced Clay Masonry Columns. The fire-resistance ratings shall be determined based on the last plan dimension of the column in accordance with Table 721.4.1(6). The minimum cover for longitudinal reinforcement shall be two inches (51 mm).

721.5 Steel Assemblies. The provisions of 780 CMR 821.5 contain procedures by which the fire-resistance ratings of steel assemblies are established by calculations.

721.5.1 Structural Steel Columns. The fire-resistance ratings of steel columns shall be based on the size of the element and the type of protection provided in accordance with780 CMR 721.5.1.

721.5.1.1 General. These procedures establish a basis for determining the fire resistance of column assemblies as a function of the thickness of fire-resistant material and, the weight, *W*, and heated perimeter, *D*, of steel columns. As used in 780 CMR 721.5.1, *W* is the average weight of a structural steel column in pounds per linear foot. The heated perimeter, *D*, is the inside perimeter of the fire-resistant material in inches as illustrated in Figure 721.5.1(1).

721.5.1.1.1 Nonload-bearing Protection. The application of these procedures shall be limited to column assemblies in which the fire-resistant material is not designed to carry any of the load acting on the column.

721.5.1.1.2 Embedments. In the absence of substantiating fire-endurance test results, ducts, conduit, piping, and similar mechanical, electrical, and plumbing installations shall not be embedded in any required fire-resistant materials.

721.5.1.1.3 Weight-to-perimeter Ratio. Table 721.5.1(1) contains weight-to-heated-perimeter ratios (*W/D*) for both contour and box fire-resistant profiles, for the wide flange shapes most often used as columns. For different fire-resistant protection profiles or column cross sections, the weight-to-heated-perimeter ratios (*W/D*) shall be determined in accordance with the definitions given in 780 CMR 721.5.

Figure 721.5.1(1)
DETERMINATION OF THE HEATED PERIMETER OF STRUCTURAL STEEL COLUMNS

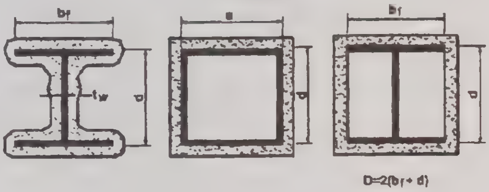
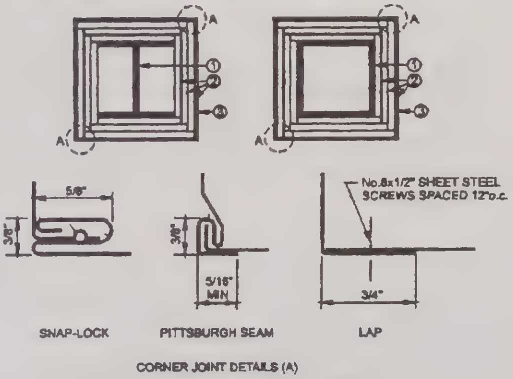


Figure 721.5.1(2)
GYPSUM WALLBOARD PROTECTED STRUCTURAL STEEL COLUMNS WITH SHEET STEEL COLUMN COVERS

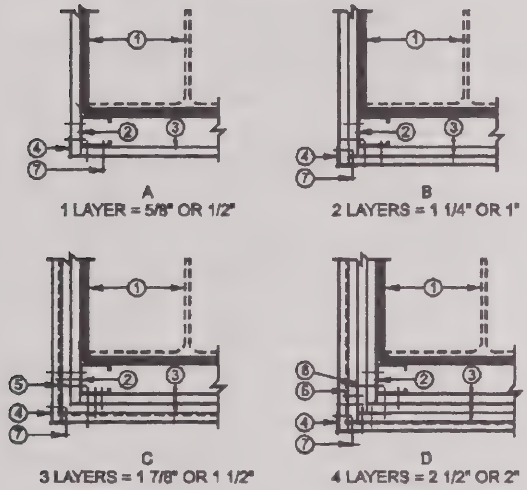


For SI: 1 inch = 25.4 mm, 1 foot = 305 mm.

1. Structural steel column, either wide flange or tubular shapes.
2. Type X gypsum wallboard in accordance with ASTM C 36. For single-layer applications, the wallboard shall be applied vertically with no horizontal joints. For multiple-layer applications, horizontal joints are permitted at a minimum spacing of 8 feet, provided that the joints in successive layers are staggered at least 12 inches. The total required thickness of wallboard shall be determined on the basis of the specified fire-resistance rating and the weight-to-heated-perimeter ratio (*W/D*) of the column. For fire-resistance ratings of two hours or less, one of the required layers of gypsum wallboard may be applied to the exterior of the sheet steel column covers with one-inch long Type S screws spaced one inch from the wallboard edge and eight inches on center. For such installations, 0.0149-inch minimum thickness galvanized steel corner beads with 1½-inch legs shall be attached to the wallboard with Type S screws spaced 12 inches on center.
3. For fire-resistance ratings of three hours or less, the column covers shall be fabricated from 0.0239-inch minimum thickness galvanized or stainless steel. For four-hour fire-resistance ratings, the column covers shall be fabricated from 0.0239-inch minimum thickness stainless steel. The column covers shall be erected with the Snap Lock or Pittsburgh joint details.

For fire-resistance ratings of two hours or less, column covers fabricated from 0.0269-inch minimum thickness galvanized or stainless steel shall be permitted to be erected with lap joints. The lap joints shall be permitted to be located anywhere around the perimeter of the column cover. The lap joints shall be secured with ½-inch-long No. 8 sheet metal screws spaced 12 inches on center. The column covers shall be provided with a minimum expansion clearance of ⅛ inch per linear foot between the ends of the cover and any restraining construction.

Figure 721.5.1(3)
GYPSUM WALLBOARD PROTECTED STRUCTURAL STEEL COLUMNS WITH STEEL STUD/SCREW ATTACHMENT SYSTEM



For SI: 1 inch = 25.4 mm, 1 foot = -305 mm.

1. Structural steel column, either wide flange or tubular shapes.
2. 1⅝-inch deep studs fabricated from 0.0179-inch minimum thickness galvanized steel with $^{15}/_{16}$ or $1^{7}/_{16}$-inch legs. The length of the steel studs shall be ½ inch less than the height of the assembly.
3. Type X gypsum wallboard in accordance with ASTM C 36. For single-layer applications, the wallboard shall be applied vertically with no horizontal joints. For multiple-layer applications, horizontal joints are permitted at a minimum spacing of eight feet, provided that the joints in successive layers are staggered at least 12 inches. The total required thickness of wallboard shall be determined on the basis of the specified fire-resistance rating and the weight-to-heated-perimeter ratio (*W/D*) of the column.
4. Galvanized 0.0149-inch minimum thickness steel corner beads with 1½-inch legs attached to the wallboard with one-inch-long Type S screws spaced 12 inches on center.
5. No. 18 SWG steel tie wires spaced 24 inches on center.
6. Sheet metal angles with 2-inch legs fabricated from 0.0221-inch minimum thickness galvanized steel.
7. Type S screws, 1 inch long, shall be used for attaching the first layer of wall -board to the steel studs and the third layer to the sheet metal angles at 24 inches on center. Type S screws 1¾-inch long shall be used for attaching the second layer of wallboard to the steel studs and the fourth layer to the sheet metal angles at 12 inches on center. Type S screws 2¼ inches long shall be used for attaching the third layer of wallboard to the steel studs at 12 inches on center.

721.5.1.2 Gypsum Wallboard Protection. The fire resistance of structural steel columns with weight- to-heated-perimeter ratios (*W/D*) less than or equal to 3.65 and which are protected with Type X gypsum wallboard shall be permitted to be determined from the following expression:

Equation 7-12

$$R = 130\left[\frac{h(W'/D)}{2}\right]^{0.75}$$

where:

R = Fire resistance (minutes).

h = Total thickness of gypsum wallboard (inches).

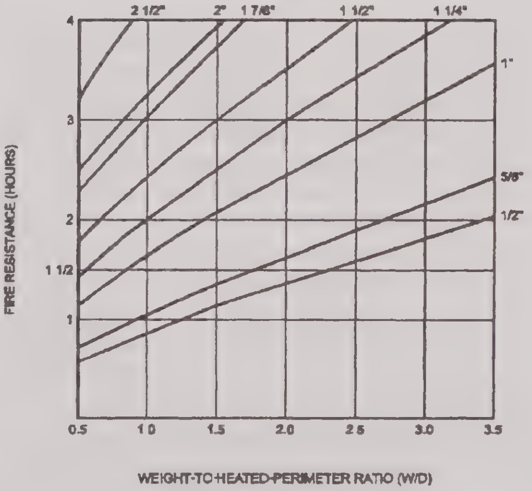
D = Heated perimeter of the structural steel column (inches).

W^1 = Total weight of the structural steel column and gypsum wallboard protection (pounds per linear foot).

$W^1 - W + 50hD/144$.

721.5.1.2.1 Attachment. The gypsum wallboard shall be supported as illustrated in either Figure 721.5.1(2) for fire-resistance ratings of four hours or less, or Figure 721.5.1(3) for fire-resistance ratings of three hours or less.

Figure 721.5.1(4)
FIRE RESISTANCE OF STRUCTURAL STEEL COLUMNS PROTECTED WITH VARIOUS THICKNESSES OF TYPE X GYPSUM WALLBOARD



For SI: 1 inch = 25.4mm, 1 pound per linear foot/inch - 0.059kg/m/mm

721.5.1.2.2 Gypsum wallboard equivalent to concrete. The determination of the fire resistance of structural steel columns from Figure 721.5.1(4) is permitted for various thicknesses of gypsum wallboard as a function of the weight-to-heated-perimeter ratio (*W/D*) of the column. For structural steel columns with weight-to-heated-perimeter ratios (*W/D*) greater than 3.65, the thickness of gypsum wallboard required for specified fire-resistance ratings shall be the same as the thickness determined for a *W*14 x 233 wide flange shape.

721.5.1.3 Spray-applied Fire-resistant Materials. The fire resistance of wide-flange structural steel columns protected with spray-applied fire-resistant materials, as illustrated in Figure 721.5.1(5), shall be permitted to be determined from the following expression:

Equation 7-13

$$R = [C_1(W/D) + C_2]h$$

where:

R = Fire resistance (minutes).

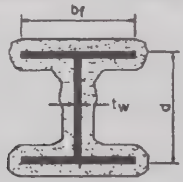
h = Thickness of spray-applied fire-resistant material (inches).

D = Heated perimeter of the structural steel column (inches).

C_1 and C_2 = Material-dependent constants.

W = Weight of structural steel column (pounds per linear foot).

Figure 721.5.1(5)
WIDE FLANGE STRUCTURAL STEEL COLUMNS WITH SPRAY-APPLIED FIRE-RESISTANT MATERIALS



721.5.1.3.1 Material-dependent Constants. The material-dependent constants, C_1 and C_2, shall be determined for specific fire-resistant materials on the basis of standard fire endurance tests in accordance with 780 CMR 703.2. Unless evidence is submitted to the building official substantiating a broader application, this expression shall be limited to determining the fire resistance of structural steel columns with weight-to-heated-perimeter ratios (*W/D*) between the largest and smallest columns for which standard fire-endurance test results are available.

721.5.1.3.2 Spray-applied Identification. Spray-applied fire-resistant materials shall be identified by density and thickness required for a given fire-resistance rating.

721.5.1.4 Concrete-protected Columns. The fire resistance of structural steel columns protected with concrete, as illustrated in Figure 721.5.1(6) (a) and (b), shall be permitted to be determined from the following expression:

Equation 7-14

$$R = R_0(1 + 0.03m)$$

Where:

$$R_o = 10(W/D)^{0.7} + 17(h^{1.6}/k_c^{0.2}) + (1 + 26(H/p_c\ c_c\ h(L + h))^{0.8})$$

As used in these expressions:

R = Fire endurance at equilibrium moisture conditions (minutes).

R_o = Fire endurance at zero moisture content (minutes).

m = Equilibrium moisture content of the concrete by volume (percent).

W = Average weight of the steel column (pounds per linear foot).

D = Heated perimeter of the steel column (inches).

h = Thickness of the concrete cover (inches).

k_c = Ambient temperature thermal conductivity of the concrete (Btu/hr ft °F).

H = Ambient temperature thermal capacity of the steel column = 0.11W (Btu/ ft °F).

p_c = Concrete density (pounds per cubic foot).

c_c = Ambient temperature specific heat of concrete(Btu/lb °F).

L = Interior dimension of one side of a square concrete box protection (inches).

721.5.1.4.1 Reentrant Space Filled. For wide-flange steel columns completely encased in concrete with all reentrant spaces filled (Figure 721.5.1(6)(c)), the thermal capacity of the concrete within the reentrant spaces shall be permitted to be added to the thermal capacity of the steel column, as follows:

Equation 7-15

$$H = 0.11W + (p_c c_c/144)(b_f d - A_s)$$

where:

b_f = Flange width of the steel column (inches).

d = Depth of the steel column (inches).

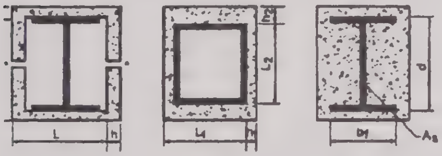
A_s = Cross-sectional area of the steel column (square inches).

721.5.1.4.2 Concrete Properties Unknown. If specific data on the properties of concrete are not available, the values given in Table 721.5.1(2) are permitted.

721.5.1.4.3 Minimum Concrete Cover. For structural steel column encased in concrete with all reentrant spaces filled, Figure 721.5.1(6)(c) and Tables 721.5.1(7) and 721.5.1(8) indicate the thickness of concrete cover required for various fire-resistance ratings for typical wide-flange sections. The thicknesses of concrete indicated in these tables also apply to structural steel columns larger than those listed.

721.5.1.4.4 Minimum Precast Concrete Cover. For structural steel columns protected with precast concrete column covers as shown in Figure 721.5.1(6)(a), Tables 721.5.1(9) and 721.5.1(10) indicate the thickness of the column covers required for various fire-resistance ratings for typical wide-flange shapes. The thicknesses of concrete given in these tables also apply to structural steel columns larger than those listed.

Figure 721.5.1(6)
CONCRETE PROTECTED STRUCTURAL STEEL COLUMNS



(a) PRECAST CONCRETE COLUMN COVERS

(b) CONCRETE ENCASED STRUCTURAL TUBE

(c) CONCRETE ENCASED WIDE-FLANGE SHAPE

Notes:

a. When the inside perimeter of the concrete protection is not square, L shall be taken as the average of L_1 and L_2. When the thickness of concrete cover is not constant, h shall be taken as the average of h_1 and h_2.

b. Joints shall be protected with a minimum 1 inch thickness of ceramic fiber blanket but in no case less than one-half the thickness of the column cover (see 780 CMR 720.2.1.3).

721.5.1.4.5 Masonry Protection. The fire resistance of structural steel columns protected with concrete masonry units or clay masonry units as illustrated in Figure 721.5.1(7), shall be permitted to be determined from the following expression:

Equation 7-16

$$R = 0.17\,(W/D)^{0.7} + [0.285\,(T_e^{1.6}/K^{0.2})]\,[1.0 + 42.7\,\{(A_s/d_m T_e)/(0.25p + T_e)\}^{0.8}]$$

where:

R = Fire-resistance rating of column assembly (hours).

W = Average weight of steel column (pounds per foot).

D = Heated perimeter of steel column (inches) (see Figure 721.5.1(7)).

T_e = Equivalent thickness of concrete or clay masonry unit (inches) (see Table 721.3.2 Note a or Section 721.4.1).

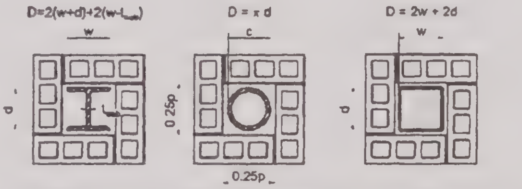
K = Thermal conductivity of concrete or clay masonry unit (Btu/hr ft °F) [see Table 721.5.1(3)].

A_s = Cross-sectional area of steel column (square inches).

d_m = Density of the concrete or clay masonry unit(pounds per cubic foot).

p = Inner perimeter of concrete or clay masonry protection (inches) [see Figure 721.5.1(7)].

Figure 721.5.1(7)
CONCRETE OR CLAY MASONRY PROTECTED STRUCTURAL STEEL COLUMNS



W SHAPE COLUMN STEEL PIPE COLUMN STRUCTURAL TUBE COLUMN

For SI: 1 inch = 25.4 mm.

d = Depth of a wide flange column, outside diameter of pipe column, or outside dimension of structural tubing column (inches).

t_{web} = Thickness of web of wide flange column (inches).

w = Width of flange of wide flange column (inches).

TABLE 721.5.1(1)
W/D RATIOS FOR STEEL COLUMNS

STRUCTURAL SHAPE	CONTOUR PROFILE	BOX PROFILE	STRUCTURAL SHAPE	CONTOUR PROFILE	BOX PROFILE
W14 x 233	2.49	3.65	W10 x 112	1.78	2.57
x 211	2.28	3.35	x 100	1.61	2.33
x 193	2.10	3.09	x 88	1.43	2 08
x 176	1.93	2.85	x 77	1.26	1.85
x 159	1.75	2.60	x 68	1.13	1.66
x 145	1.61	2.39	x 60	1.00	1 48
x 132	1.52	2.25	x 54	0.91	1.34
x 120	1.39	2.06	x 49	0.83	1.23
x 109	1.27	1.88	x 45	0.87	1.24
x 99	1.16	1.72	x 39	0.76	1.09
x 90	1.06	1.58	x 33	0.65	0.93
x 82	1.20	1.68			
x 74	1.09	1.53	W8 x 67	1.34	1.94
x 68	1.01	1.41	x 58	1.18	1.71
x 61	0.91	1.28	x 48	0.99S	1.44
x 53	0.89	1.21	x 40	0.83	1.23
x 48	0.81	1.10	x 35	0.73	1.08
x 43	0.73	0.99	x 31	0.65	0.97
			x 28	0.67	0.96
W12 x 190	2.46	3.51	x 24	0.58	0.83
x 170	2.22	3.20	x 21	0.57	0.77
x 152	2.01	2 90	×18	0.49	0.67
x 136	1.82	2.63			
x 120	1.62	2.36	W6 x 25	0.69	1.00
x 106	1.44	2.11	x 20	0.56	0.82
x 96	1.32	1.93	x 16	0.57	0.78
x 87	1.20	1.76	x 15	0.42	0.63
x 79	1.10	1.61	x 12	0.43	0.60
x 72	1.00	1.48	×9	0.33	0.46
x 65	0.91	1.35			
x 58	0.91	1.31	W5 x 19	0.64	0.93
x 53	0.84	1.20	x 16	0.54	0.80
x 50	0.89	1.23			
x 45	0 81	1.12	W4 x 13	0.54	0.79
x 40	0.72	1.00			

For SI: 1 pound per linear foot per inch = 0.059 kg/m/mm.

TABLE 721.5.1(2)
PROPERTIES OF CONCRETE

PROPERTY	NORMAL WEIGHT CONCRETE	STRUCTURAL LIGHTWEIGHT CONCRETE
Thermal conductivity (k_c)	0.95 Btu/hr ft °F	0.35 Btu/hr ft °F
Specific heat (c_c)	0.20 Btu/lb °F	0.20 Btu/lb °F
Density (P_c)	145 lb/ft^3	110 lb/ft^3
Equilibrium (free) moisture content (m) by volume	4%	5%

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 lb/ft^3 = 16.0185 kg/m^3, Btu/hr ft °F = 1.731 W/(m K)

TABLE 721.5.1(3)
THERMAL CONDUCTIVITY OF CONCRETE OR CLAY MASONRY UNITS

DENSITY (dm) OF UNITS (lb/ft^3)	THERMAL CONDUCTIVITY (K) OF UNITS (Btu/hr ft °F)
Concrete Masonry Units	
80	0.207
85	0.228
90	0.252
95	0.278
100	0.308
105	0.34
110	0.376
115	0.416
120	0.459
125	0.508
130	0.561
135	0.62
140	0.685
145	0.758
150	0.837
Clay Masonry Units	
120	1.25
130	2.25

For SI: 1 pound per cubic foot = 16.0185 kg/m^3, Btu per hour foot °F = 1.731 W/(m K).

TABLE 721.5.1(4)
WEIGHT-TO-HEATED-PERIMETER RATIOS (*W/D*)FOR TYPICAL WIDE FLANGE BEAM AND GIRDER SHAPES

STRUCTURAL SHAPE	CONTOUR PROFILE	BOX PROFILE	STRUCTURAL SHAPE	CONTOUR PROFILE	BOX PROFILE
W36 x 300	2.47	3.33	x 68	0.92	1.21
x 280	2.31	3.12	x 62	0.92	1.14
x 260	2.16	2.92	x 55	0.82	1.02
x 245	2.04	2.76			
x 230	1.92	2.61	W21 x 147	1.83	2.60
x 210	1.94	2.45	x 132	1.66	2.35
x 194	1.80	2.28	x 122	1.54	2.19
x 182	1.69	2.15	x 111	1.41	2.01
x 170	1.59	2.01	x 101	1.29	1.84
x 160	1.50	1.90	×93	1.38	1.80
x 150	1.41	1.79	×83	1.24	1.62
x 135	1.28	1.63	×73	1.10	1.44
			×68	1.03	1.35
W33 x 241	2.11	2.86	×62	0.94	1.23
x 221	1.94	2.64	×57	0.93	1.17
x 201	1.78	2.42	×50	0.83	1.04
x 152	1.51	1.94	×44	0.73	0.92
x 141	1.41	1.80			
x 130	1.31	1.67	W18 x 119	1.69	2.42
x 118	1.19	1.53	x 106	1.52	2.18
			×97	1.39	2.01
W30 x 211	2.00	2.74	×86	1.24	1.80
x 191	1.82	2.50	×76	1.11	1.60
x 173	1.66	2.28	×71	1.21	1.59
x 132	1.45	1.85	×65	1.11	1.47
x 124	1.37	1.75	×60	1.03	1.36
x 116	1.28	1.65	×55	0.95	1.26
x 108	1.20	1.54	×50	0.87	1.15
x 99	1.10	1.42	×46	0.86	1.09
			×40	0.75	0.96
W27 x 178	1.85	2.55	×35	0.66	0.85
x 161	1.68	2.33			
x 146	1.53	2.12	W16 x 100	1.56	2.25
x 114	1.36	1.76	×89	1.40	2.03
x 102	1.23	1.59	×77	1.22	1.78
×94	1.13	1.47	×67	1.07	1.56
×84	1.02	1.33	×57	1.07	1.43

TABLE 721.5.1(4)
WEIGHT-TO-HEATED-PERIMETER RATIOS (*W/D*)FOR TYPICAL WIDE FLANGE BEAM AND GIRDER SHAPES - continued

STRUCTURAL SHAPE	CONTOUR PROFILE	BOX PROFILE	STRUCTURAL SHAPE	CONTOUR PROFILE	BOX PROFILE
			×50	0.94	1.26
			×45	0.85	1.15
W24 x 162	1.85	2.57	×40	0.76	1.03
x 146	1.68	2.34	×36	0.69	0.93
x 131	1.52	2.12	×31	0.65	0.83
x 117	1.36	1.91	×26	0.55	0.70
x 104	1.22	1.71			
×94	1.26	1.63	W14 x 132	1.83	3.00
×84	1.13	1.47	x 120	1.67	2.75
×76	1.03	1.34	x 109	1.53	2.52
×99	1.39	2.31	x 30	0.79	1.12
×90	1.27	2.11	x 26	0.69	0.98
×82	1.41	2.12	x 22	0.59	0.84
×74	1.28	1.93	x 19	0.59	0.78
×68	1.19	1.78	x 17	0.54	0.70
×61	1.07	1.61	x 15	0.48	0.63
×53	1.03	1.48	x 12	0.38	0.51
×48	0.94	1.35			
×43	0.85	1.22	W8 x 67	1.61	2.55
×38	0.79	1.09	x 58	1.41	2.26
×34	0.71	0.98	x 48	1.18	1.91
×30	0.63	0.87	x 40	1.00	1.63
×26	0.61	0.79	x 35	0.88	1.44
×22	0.52	0.68	x 31	0.79	1.29
			x 28	0.80	1.24
W12 x 87	1.44	2.34	x 24	0.69	1.07
×79	1.32	2.14	x 21	0.66	0.96
×72	1.20	1.97	x 18	0.57	0.84
×65	1.09	1.79	x 15	0.54	0.74
×58	1.08	1.69	x 13	0.47	0.65
×53	0.99	1.55	x 10	0.37	0.51
×50	1.04	1.54			
×45	0.95	1.40	W6 x 25	0.82	1.33
×40	0.85	1.25	x 20	0.67	1.09
×35	0.79	1.11	x 16	0.66	0.96
×30	0.69	0.96	x 15	0.51	0.83
×26	0.60	0.84	x 12	0.51	0.75
×22	0.61	0.77	×9	0.39	0.57
×19	0.53	0.67			
×16	0.45	0.57	W5 x 19	0.76	1.24
×14	0.40	0.50	x 16	0.65	1.07
W10 x 112	2.14	3.38	W4 x 13	0.65	1.05
x 100	1.93	3.07			
×88	1.7	2.75			
×77	1.52	2.45			
×68	1.35	2.20			
×60	1.20	1.97			
×54	1.09	1.79			
×49	0.99	1.64			
×45	1.03	1.59			
×39	0.94	1.40			
×33	0.77	1.2			

TABLE 721.5.1(5)
FIRE RESISTANCE OF CONCRETE MASONRY PROTECTED STEEL COLUMNS

COLUMN SIZE	CONCRETE MASONRY DENSITY POUNDS PER CUBIC FOOT	MINIMUM REQUIRED EQUIVALENT THICKNESS FOR FIRE-RESISTANCE RATING OF CONCRETE. MASONRY PROTECTION ASSEMBLY T_e, (inches)				COLUMN SIZE	CONCRETE MASONRY DENSITY POUNDS PER CUBIC FOOT	MINIMUM REQUIRED EQUIVALENT THICKNESS FOR FIRE-RESISTANCE RATING OF CONCRETE. MASONRY PROTECTION ASSEMBLY T_e, (inches)			
		1-hour	2-hour	3-hour	4-hour			1-hour	2-hour	3-hour	4-hour
W14 x 82	80	0.74	1.61	2.36	3.04	W10 x 68	80	0.72	1.58	2.33	3.01
	100	0.89	1.85	2.67	3.4		100	0.87	1.83	2.65	3.38
	110	0.96	1.97	2.81	3.57		110	0.94	1.95	2.79	3.55
	120	1.03	2.08	2.95	3.73		120	1.01	2.06	2.94	3.72
W14 x 68	80	0.83	1.7	2.45	3.13	W10 x 54	80	0.88	1.76	2.53	3.21
	100	0.99	1.95	2.76	3.49		100	1.04	2.01	2.83	3.57
	110	1.06	2.06	2.91	3.66		110	1.11	2.12	2.98	3.73
	120	1.14	2.18	3.05	3.82		120	1.19	2.24	3.12	3.9
W14 x 53	80	0.91	1.81	2.58	3.27	W10 x 45	80	0.92	1.83	2.6	3.3
	100	1.07	2.05	2.88	3.62		100	1.08	2.07	2.9	3.64
	110	1.15	2.17	3.02	3.78		110	1.16	2.18	3.04	3.8
	120	1.22	2.28	3.16	3.94		120	1.23	2.29	3.18	3.96
W14 x 43	80	1.01	1.93	2.71	3.41	W10 x 33	80	1.06	2	2.79	3.49
	100	1.17	2.17	3	3.74		100	1.22	2.23	3.07	3.81
	110	1.25	2.28	3.14	3.9		110	1.3	2.34	3.2	3.96
	120	1.32	2.38	3.27	4.05		120	1.37	2.44	3.33	4.12
W12 x 72	80	0.81	1.66	2.41	3.09	W8 x 40	80	0.94	1.85	2.63	3.33
	100	0.91	1.88	2.7	3.43		100	1.1	2.1	2.93	3.67
	110	0.99	1.99	2.84	3.6		110	1.18	2.21	3.07	3.83
	120	1.06	2.1	2.98	3.76		120	1.25	2.32	3.2	3.99
W12 x 58	80	0.88	1.76	2.52	3.21	W8 x 31	80	1.06	2	2.78	3.49
	100	1.04	2.01	2.83	3.56		100	1.22	2.23	3.07	3.81
	110	1.11	2.12	2.97	3.73		110	1.29	2.33	3.2	3.97
	120	1.19	2.23	3.11	3.89		120	1.36	2.44	3.33	4.12
W12 x 50	80	0.91	1.81	2.58	3.27	W8 x 24	80	1.14	2.09	2.89	3.59
	100	1.07	2.05	2.88	3.62		100	1.29	2.31	3.16	3.9
	110	1.15	2.17	3.02	3.78		110	1.36	2.42	3.28	4.05
	120	1.22	2.28	3.16	3.94		120	1.43	2.52	3.41	4.2
W12 x 40	80	1.01	1.94	2.72	3.41	W8 x 18	110	1.22	2.2	3.01	3.72
	100	1.17	2.17	3.01	3.75		100	1.36	2.4	3.25	4.01
	110	1.25	2.28	3.14	3.9		110	1.42	2.5	3.37	4.14
	120	1.32	2.39	3.27	4.06		120	1.48	2.59	3.49	4.28
COLUMN SIZE	CONCRETE MASONRY DENSITY POUNDS PER CUBIC FOOT	MINIMUM REQUIRED EQUIVALENT THICKNESS FOR FIRE-RESISTANCE RATING OF CONCRETE. MASONRY PROTECTION ASSEMBLY T_e, (inches)				COLUMN SIZE	CONCRETE MASONRY DENSITY POUNDS PER CUBIC FOOT	MINIMUM REQUIRED EQUIVALENT THICKNESS FOR FIRE-RESISTANCE RATING OF CONCRETE. MASONRY PROTECTION ASSEMBLY T_e, (inches)			
		1-hour	2-hour	3-hour	4-hour			1-hour	2-hour	3-hour	4-hour
4 x 4 x ½ wall thickness	80	0.93	1.9	2.71	3.43	4 double extra strong 0.674 wall thickness	80	0.8	1.75	2.56	3.28
	100	1.08	2.13	2.99	3.76		100	0.95	1.99	2.85	3.62
	110	1.16	2.24	3.13	3.91		110	1.02	2.1	2.99	3.78
	120	1.22	2.34	3.26	4.06		120	1.09	2.2	3.12	3.93

TABLE 721.5.1(5)
FIRE RESISTANCE OF CONCRETE MASONRY PROTECTED STEEL COLUMNS - continued

COLUMN SIZE	CONCRETE MASONRY DENSITY POUNDS PER CUBIC FOOT	MINIMUM REQUIRED EQUIVALENT THICKNESS FOR FIRE-RESISTANCE RATING OF CONCRETE. MASONRY PROTECTION ASSEMBLY T_e, (inches)				COLUMN SIZE	CONCRETE MASONRY DENSITY POUNDS PER CUBIC FOOT	MINIMUM REQUIRED EQUIVALENT THICKNESS FOR FIRE-RESISTANCE RATING OF CONCRETE. MASONRY PROTECTION ASSEMBLY T_e, (inches)			
		1-hour	2-hour	3-hour	4-hour			1-hour	2-hour	3-hour	4-hour
4 x 4 x ⅜ wall thickness	80	1.05	2.03	2.84	3.57	4 extra strong 0.337 wall thickness	80	1.12	2.11	2.93	3.65
	100	1.2	2.25	3.11	3.88		100	1.26	2.32	3.19	3.95
	110	1.27	2.35	3.24	4.02		110	1.33	2.42	3.31	4.09
	120	1.34	2.45	3.37	4.17		120	1.4	2.52	3.43	4.23
4 x 4 x ¼ wall thickness	80	1.21	2.2	3.01	3.73	4 standard 0.237 wall thickness	80	1.26	2.25	3.07	3.79
	100	1.35	2.4	3.26	4.02		100	1.4	2.45	3.31	4.07
	110	1.41	2.5	3.38	4.16		110	1.46	2.55	3.43	4.21
	120	1.48	2.59	3.5	4.3		120	1.53	2.64	3.54	4.34
6 x 6 x ½ wall thickness	80	0.82	1.75	2.54	3.25	5 double extra strong 0.750 wall thickness	80	0.7	1.61	2.4	3.12
	100	0.98	1.99	2.84	3.59		100	0.85	1.86	2.71	3.47
	110	1.05	2.1	2.98	3.75		110	0.91	1.97	2.85	3.63
	120	1.12	2.21	3.11	3.91		120	0.98	2.02	2.99	3.79
6 x 6 x ⅜ wall thickness	80	0.96	1.91	2.71	3.42	5 extra strong 0.375 wall thickness	80	1.04	2.01	2.83	3.54
	100	1.12	2.14	3	3.75		100	1.19	2.23	3.09	3.85
	110	1.19	2.25	3.13	3.9		110	1.26	2.34	3.22	4
	120	1.26	2.35	3.26	4.05		120	1.32	2.44	3.34	4.14
6 x 6 x ¼ wall thickness	80	1.14	2.11	2.92	3.63	5 standard 0.258 wall thickness	80	1.2	2.19	3	3.72
	100	1.29	2.32	3.18	3.93		100	1.34	2.39	3.25	4
	110	1.36	2.43	3.3	4.08		110	1.41	2.49	3.37	4.14
	120	1.42	2.52	3.43	4.22		120	1.47	2.58	3.49	4.28
8 x 8 x ½ wall thickness	80	0.77	1.66	2.44	3.13	6 double extra strong 0.864 wall thickness	80	0.59	1.46	2.23	2.92
	100	0.92	1.91	2.75	3.49		100	0.73	1.71	2.54	3.29
	110	1	2.02	2.89	3.66		110	0.8	1.82	2.69	3.47
	120	1.07	2.14	3.03	3.82		120	0.86	1.93	2.83	3.63
8 x 8 x ⅜ wall thickness	80	0.91	1.84	2.63	3.33	6 extra strong 0.432 wall thickness	80	0.94	1.9	2.7	3.42
	100	1.07	2.08	2.92	3.67		100	1.1	2.13	2.98	3.74
	110	1.14	2.19	3.06	3.83		110	1.17	2.23	3.11	3.89
	120	1.21	2.29	3.19	3.98		120	1.24	2.34	3.24	4.04
8 x 8 x ¼ wall thickness	80	1.1	2.06	2.86	3.57	6 standard 0.280 wall thickness	80	1.14	2.12	2.93	3.64
	100	1.25	2.28	3.13	3.87		100	1.29	2.33	3.19	3.94
	110	1.32	2.38	3.25	4.02		110	1.36	2.43	3.31	4.08
	120	1.39	2.48	3.38	4.17		120	1.42	2.53	3.43	4.22

For SI: 1 inch = 25.4 mm, 1 pound per cubic feet = 16.02 kg/m^3.

Note: Tabulated values assume one-inch air gap between masonry and steel section.

TABLE 721.5.1(6)
FIRE RESISTANCE OF CLAY MASONRY PROTECTED STEEL COLUMNS

COLUMN SIZE	CLAY MASONRY DENSITY, POUNDS PER CUBIC FOOT	MINIMUM REQUIRED EQUIVALENT THICKNESS FOR FIRE-RESISTANCE RATING OF CLAY. MASONRY PROTECTION ASSEMBLY T_e, (inches)				COLUMN SIZE	CLAY MASONRY DENSITY, POUNDS PER CUBIC FOOT	MINIMUM REQUIRED EQUIVALENT THICKNESS FOR FIRE-RESISTANCE RATING OF CLAY MASONRY PROTECTION ASSEMBLY T_e, (inches)			
		1-hour	2-hour	3-hour	4-hour			1-hour	2-hour	3-hour	4-hour
W14 × 82	120	1.23	2.42	3.41	4.29	W10 x 68	120	1.27	2.46	3.26	4.35
	130	1.4	2.7	3.78	4.74		130	1.44	2.75	3.83	4.8
W14 x 68	120	1.34	2.54	3.54	4.43	W10 x 54	120	1.4	2.61	3.62	4.51
	130	1.51	2.82	3.91	4.87		130	1.58	2.89	3.98	4.95
W14 x 53	120	1.43	2.65	3.65	4.54	W10 x 45	120	1.44	2.66	3 67	4.57
	130	1.61	2.93	4.02	4.98		130	1.62	2.95	4.04	5.01
W14 x 43	120	1.54	2 76	3.77	4.66	W10 x 33	120	1.59	2.82	3.84	4.73
	130	1.72	3.04	4.13	5.09		130	1.77	3.1	4.2	5.13
W12 x 72	120	1.32	2.52	3.51	4.4	W8 x 40	120	1.47	2.7	3.71	4.61
	130	1.5	2.8	3.88	4.84		130	1.65	2.98	4.08	5.04
W12 x 58	120	1.4	2.61	3.61	4.5	W8 x 31	120	1.59	2.82	3.84	4.73
	130	1.57	2.89	3.98	4.94		130	1.77	3.1	4.2	5.17
W12 x 50	120	1.43	2.65	3.66	4.55	W8 x 24	120	1.66	2.9	3.92	4.82
	130	1.61	2.93	4.02	4.99		130	1.84	3.18	4.28	5.25
W12 x 40	120	1.54	2.77	3.78	4.67	W8 x 18	120	1.75	3	4.01	4.91
	130	1.72	3.05	4.14	5.1		130	1.93	3.27	4.37	5.34

Steel tubing						Steel pipe					
Nominal tube size (inches)	**Clay masonry density, pounds per cubic foot**	**Minimum required equivalent thickness for fire-resistance rating of clay. Masonry protection assembly T_e, (inches)**				**Nominal pipe size (inches)**	**Clay masonry density, pounds per cubic foot**	**Minimum required equivalent thickness for fire-resistance rating of clay. Masonry protection assembly T_e, (inches)**			
		1-hour	**2-hour**	**3-hour**	**4-hour**			**1-hour**	**2-hour**	**3-hour**	**4-hour**
4 x 4 x ½ wall thickness	120	1.44	2.72	3.76	4.68	4 double extra strong 0.674 wall thickness	120	1.26	2.55	3.6	4.52
	130	1.62	3	4.12	5.11		130	1.42	2.82	3.96	4.95
4 x 4 x ⅜ wall thickness	120	1.56	2.84	3.88	4.78	4 extra strong 0.337 wall thickness	120	1.6	2.89	3.92	4.83
	130	1.74	3.12	4.23	5.21		130	1.77	3.16	4.28	5.25
4 x 4 x ¼ wall thickness	120	1.72	2.99	4.02	4.92	4 standard 0.237 wall thickness	120	1.74	3.02	4.05	4.95
	130	1.89	3.26	4.37	5.34		130	1.92	3.29	4.4	5.37
6 x 6 x ½ wall thickness	120	1.33	2.58	3.62	4.52	5 double extra strong 0.750 wall thickness	120	1.17	2.44	3.48	4.4
	130	1.5	2.86	3.98	4.96		130	1.33	2.72	3.84	4.83
6 x 6 x ⅜ wall thickness	120	1.48	2.74	3.76	4.67	5 extra strong 0.375 wall thickness	120	1.55	2.82	3.85	4.76
	130	1.65	3.01	4.13	5.1		130	1.72	3.09	4.21	5.18
6 x 6 x ¼ wall thickness	120	1.66	2.91	3.94	4.84	5 standard 0.258 wall thickness	120	1.71	2.97	4	4.9
	130	1.83	3.19	4.3	5.27		130	1.88	3.24	4.35	5.32
8 x 8 x ½ wall thickness	120	1.27	2.5	3.52	4.42	6 double extra strong 0.864 wall thickness	120	1.04	2.28	3.32	4.23
	130	1 44	2.78	3.89	4.86		130	1.19	2.6	3.68	4.67
8 x 8 x ⅜ wall thickness	120	1.43	2 67	3.69	4.59	6 extra strong 0.432 wall thickness	120	1.45	2.71	3.75	4 65
	130	1.6	2.95	4.05	5.02		130	1.62	2.99	4.1	5.08
8 x 8 x ¼ wall thickness	120	1.62	2.87	3.89	4.78	6 standard 0.280 wall thickness	120	1.65	2.91	3.94	4.84
	130	1.79	3.14	4.24	5.21		130	1.82	3.19	4.3	5.27

TABLE 721.5.1(7)
MINIMUM COVER (inch) FOR STEEL COLUMNS ENCASED IN NORMAL-WEIGHT CONCRETE

STRUCTURAL SHAPE	FIRE-RESISTANCE RATING (hours)				
	1	1½	2	3	4
W14 x 233	1	1	1	1½	2
x 176					2½
x 132				2	
x 90			1½		
x 61					3
x 48		1½		2½	
x 43					
W12 x 152	1	1	1	2	2½
x 96					
x 65		1½	1½		3
x 50				2½	
x 40					
W10 x 88	1	1½	1½	2	3
x 49	1			2½	
x 45					
x 39					3½
x 33			2		
W8 x 67	1	1	1½	2½	3
x 58					
x 48		1½			3½
x 31			2	3	
x 21					
x 18					4
W6 x 25	1	1½	2	3	3½
x 20		2	2½		4
x 16					
x 15	1½				
x 9				3½	

For SI: 1 inch = 25.4 mm.

a. The tabulated thicknesses are based upon the assumed properties of normal-weight concrete given in Table 721.5.1(2).

TABLE 721.5.1(8)
MINIMUM COVER (inch) FOR STEEL COLUMNS ENCASED IN STRUCTURAL LIGHTWEIGHT CONCRETE

STRUCTURAL SHAPE	FIRE-RESISTANCE RATING (HOURS)				
	1	1½	2	3	4
W14 × 233	1	1	1	1	1½
x 193				1½	
x 74					2
x 61					2½
x 43			1½	2	
W12 × 65	1	1	1	1½	2
x 53				2	2½
x 40			1½		
W10 × 112	1	1	1	1½	2
x 88					
x 60				2	2½
x 33			1½		
W8 x 35	1	1	1½	2	2½
x 28					3
x 24				2½	
x 18		1½			

For SI: 1 inch = 25.4 mm.

a. The tabulated thicknesses are based upon the assumed properties of normal-weight concrete given in Table 721.5.1(2).

TABLE 721.5.1(9)
MINIMUM COVER (inch) FOR STEEL COLUMNS IN NORMAL-WEIGHT PRECAST COVERS

STRUCTURAL SHAPE	FIRE-RESISTANCE RATING (hours)				
	1	1 ½	2	3	4
W14 x 233	1½	1½	1½	2½	3
x 211					3½
x 176			2		
x 145				3	
x 109		2	2½		
x 99					4
x 61				3½	
x 43					4½
W12 x 190	1½	1½	1½	2½	3½
x 152			2		
x 120				3	4
x 96					
x 87		2	2½	3½	
x 58					4½
x 40					
W10 x 112	1½	1½	2	3	3½
x 88					4
x 77		2	2½		
x 54				3½	
x 33					4 ½
W8 x 67	1½	1½	2	3	4
x 58		2	2½	3½	
x 48					
x 28					4½
x 21		2½	3		
x 18				4	
W6 x 25	1½	2	2½	3½	4½
x 20		2½	3		
x 16				4	
x 12	2				
x 9					5

For SI: 1 inch = 25.4 mm.

a. The tabulated thicknesses are based upon the assumed properties of normal-weight concrete given in Table 721.5.1(2)

TABLE 721.5.1(10)
MINIMUM COVER (inch) FOR STEEL COLUMNS IN STRUCTURAL LIGHTWEIGHT PRECAST COVERS

STRUCTURAL SHAPE	½FIRE-RESISTANCE RATING (hours)				
	1	1½	2	3	4
W14 x 233	1½	1½	1½	2	2½
x 176					3
x 145				2 ½	
x 132					
x 109					
x 99			2		
x 68					3 ½
x 43				3	
W12 190	1½	1½	1½	2	2 ½
x 152					
x 136					3
x 106				2½	
x 96					3½
x 87					
x 65			2		
x 40				3	
W10 × 112	1½	1½	1 ½	2	3
x 100				2½	
x 88					
x 77			2		3½
x 60					
x 39				3	
x 33		2			
W8 x 67	1½	1½	1½	2½	3
x 48			2	3	3½
x 35					
x 28		2			
x 18			2½		4
W6 x 25	1½	2	2	3	3½
x 15			2½		4
x 9				3½	

For SI: 1 inch = 25.4 mm.

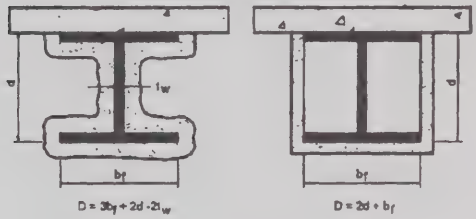
a. The tabulated thicknesses are based upon the assumed properties of structural lightweight concrete given in Table 721 .5.1(2).

721.5.1.4.6 Equivalent Concrete Masonry Thickness. For structural steel columns protected with concrete masonry, Table 721.5.1(5) gives the equivalent thickness of concrete masonry required for various fire-resistance ratings for typical column shapes. For structural steel columns protected with clay masonry, Table 721.5.1(6) gives the equivalent thickness of concrete masonry required for various fire-resistance ratings for typical column shapes.

721.5.2 Structural Steel Beams and Girders. The fire-resistance ratings of steel beams and girders shall be based upon the size of the element and the type of protection provided in accordance with 780 CMR 721.5.2.

721.5.2.1 Determination of Fire Resistance. These procedures establish a basis for determining resistance of structural steel beams and girders which differ in size from that specified in approved fire-resistance-rated assemblies as a function of the thickness of fire-resistant material and the weight (*W*) and heated perimeter (*D*) of the beam or girder. As used in 780CMR 721.5.2.1, *W* is the average weight of a structural steel member in pounds per linear foot (plf). The heated perimeter, *D*, is the inside perimeter of the fire-resistant material in inches as illustrated in Figure 721.5.2.

FIGURE 721.5.2
DETERMINATION OF THE HEATED PERIMETER OF STRUCTURAL STEEL BEAMS AND GIRDERS



721.5.2.1.1 Weight-to-heated Perimeter. The weight-to-heated-perimeter ratios (*W/D*), for both contour and box fire-resistant protection profiles, for the wide flange shapes most often used as beams or girders are given in Table 721.5.1(4). For different shapes, the weight-to-heated-perimeter ratios (*W/D*) shall be determined in accordance with the definitions given in 780 CMR 721.5.2.1.

721.5.2.1.2 Beam and Girder Substitutions. Except as provided for in 780 CMR 721.5.2.2, structural steel beams in approved fire-resistance-rated assemblies shall be considered the minimum permissible size. Other beam or girder shapes shall be permitted to be substituted provided that the weight-to-heated-perimeter ratio (*W/D*) of the substitute beam is equal to or greater than that of the beam specified in the approved assembly.

721.5.2.2 Spray-applied Fire-resistant Materials. The provisions in 780 CMR 721.5.2.2 apply to unrestrained structural steel beams and girders protected with spray-applied fire-resistance-rated materials. Larger or smaller unrestrained beam and girder shapes shall be permitted to be substituted for beams specified in approved unrestrained or restrained fire-resistance-rated assemblies provided that the thickness of the fire-resistant material is adjusted in accordance with the following expression:

Equation 7-17

$$h_2 = \left[\frac{(W_1/D_1) + 0.60}{(W_2/D_2) + 0.60} \right] h_1$$

where:

h = Thickness of spray-applied fire-resistant material in inches.

W = Weight of the structural steel beam or girder in pounds per linear foot.

D = Heated perimeter of the structural steel beam or girder in inches.

Subscript 1 refers to the beam and fire-resistant material thickness in the approved assembly.

Subscript 2 refers to the substitute beam or girder and the required thickness of fire-resistant material.

721.5.2.2.1 Minimum Thickness. Equation 7-17 is limited to beams with a weight-to-heated-perimeter ratio (*W/D*) of 0.37 or greater. The minimum thickness of fire-resistant material shall not be less than ⅜ inch (9.5 mm).

721.5.2.3 Structural Steel Trusses. The fire resistance of structural steel trusses protected with fire-resistant materials spray applied to each of the individual truss elements shall be permitted to be determined in accordance with 780 CMR 721.5.2.3. The thickness of the fire-resistant material shall be determined in accordance with 780 CMR 721.5.1.3. The weight-to-heated-perimeter ratio (*W/D*) of truss elements that can be simultaneously exposed to fire on all sides shall be determined on the same basis as columns, as specified in 780 CMR 721.5.1.1. The weight-to-heated-perimeter ratio (*W/D*) of truss elements that directly support floor or roof construction shall be determined on the same basis as beams and girders, as specified in 780 CMR 721.5.2.1.

721.6 Wood Assemblies. The provisions of 780 CMR 721.6 contain procedures by which the fire-resistance ratings of wood assemblies are established by calculations.

721.6.1 General. 780 CMR 721.6.1 contains procedures for calculating the fire-resistance ratings of walls, floor/ceiling and roof/ceiling assemblies based in part on the standard method of testing referenced in 780 CMR 703.2.

721.6.1.1 Maximum Fire-resistance Rating. Fire-resistance ratings calculated using the procedures in 780 CMR 721.6.1.1 shall be used only for one-hour rated assemblies.

721.6.1.2 Dissimilar Membranes. Where dissimilar membranes are used on a wall assembly, the calculation shall be made from the least fire-resistant (weaker) side.

721.6.2 Walls, Floors and Roofs. These procedures apply to both load-bearing and nonload-bearing assemblies.

721.6.2.1 Fire-resistance Rating of Wood Frame Assemblies. The fire-resistance rating of a wood frame assembly is equal to the sum of the time assigned to the membrane on the fire-exposed side, the time assigned to the framing members and the time assigned for additional contribution by other protective measures such as insulation. The membrane on the unexposed side shall not be included in determining the fire resistance of the assembly.

721.6.2.2 Time Assigned to Membranes. Table 721.6.2(1) indicates the time assigned to membranes on the fire-exposed side.

721.6.2.3 Exterior Walls. For an exterior wall having more than five feet (1524 mm) of horizontal separation, the wall is assigned a rating dependent on the interior membrane and the framing as described in Tables 721.6.2(1) and 721.6.2(2). The membrane on the outside of the nonfire-exposed side of exterior walls having more than five feet (1524 mm) of horizontal separation may consist of sheathing, sheathing paper, and siding as described in Table 721.6.2(3).

TABLE 721.6.2(1)
TIME ASSIGNED TO WALLBOARD MEMBRANES

DESCRIPTION OF FINISH	TIME[e] (minutes)
⅜-inch wood structural panel bonded with exterior glue	5
$^{15}/_{32}$-inch wood structural panel bonded with exterior glue	10
$^{19}/_{32}$-inch wood structural panel bonded with exterior glue	15
⅜-inch gypsum wallboard	10
½-inch gypsum wallboard	15
⅝-inch gypsum wallboard	30
½-inch Type X gypsum wallboard	25
⅝-inch Type X gypsum wallboard	40
Double ⅜-inch gypsum wallboard	25
½- + ⅜-inch gypsum wallboard	35
Double ½-inch gypsum wallboard	40

For SI: 1 inch = 25.4 mm.

a. These values apply only when membranes are installed on framing members which are spaced 16 inches o.c.

b. Gypsum wallboard installed over framing or furring shall be installed so that all edges are supported, except ⅝-inch Type X gypsum wallboard shall be permitted to be installed horizontally with the horizontal joints staggered 24 inches each side and unsupported but finished.

c. On wood frame floor/ceiling or roof/ceiling assemblies, gypsum board shall be installed with the long dimension perpendicular to framing members and shall have all joints finished.

d. The membrane on the unexposed side shall not be included in determining the fire

e. resistance of the assembly. When dissimilar membranes are used on a wall assembly, the calculation shall be made from the least fire-resistant (weaker) side. e. The time assigned is not a finished rating.

TABLE 721.6.2(2)
TIME ASSIGNED FOR CONTRIBUTION OF WOOD FRAME

DESCRIPTION	TIME ASSIGNED TO FRAME (minutes)
Wood studs 16 inches o.c.	20
Wood floor and roof joists 16 inches o.c.	10

For SI: 1 inch = 25.4 mm.

a. This table does not apply to studs or joists spaced more than 16 inches o.c.

b. All studs shall be nominal 2 × 4 and all joists shall have a nominal thickness of at least 2 inches.

c. Allowable spans for joists shall be determined in accordance with 780 CMR 2308.8, 2308.10.2 and 2308.10.3.

TABLE 721.6.2(3)
MEMBRANE ON EXTERIOR FACE OF WOOD STUD WALLS SHEATHING

SHEATHING	PAPER	EXTERIOR FINISH
⅝-inch T & G lumber $^{5}/_{16}$-inch exterior glue plywood ½-inch gypsum wallboard ⅝-inch gypsum wallboard ½-inch fiberboard	Sheathing paper	Lumber siding Wood shingles and shakes ¼-inch wood structural panels—exterior type ¼-inch hardboard Metal siding Stucco on metal lath Masonry veneer
None	—	⅜-inch exterior-grade wood structural panels

For SI: 1 pound/cubic feet = 16.0185 kg/m^2.

a. Any combination of sheathing, paper, and exterior finish is permitted.

TABLE 721.6.2(4)
FLOORING OR ROOFING OVER WOOD FRAMING

ASSEMBLY	STRUCTURAL MEMBERS	SUBFLOOR OR ROOF DECK	FINISHED FLOORING OR ROOFING
Floor	Wood	$^{15}/_{32}$-inch wood structural panels or $^{11}/_{16}$-inch T & G softwood	Hardwood or softwood flooring on building paper resilient flooring, parquet floor felted-synthetic fiber floor coverings, carpeting, or ceramic tile on ⅜-inch-thick panel-type underlay Ceramic tile on 1¼-inch mortar bed
Roof	Wood	$^{15}/_{32}$-inch wood structural panels or $^{11}/_{16}$-inch T & G softwood	Finished roofing material with or without insulation

For SI: 1 pound/cubic foot = 16.0185 kg/m^3 .

TABLE 721.6.2(5)
TIME ASSIGNED FOR ADDITIONAL

DESCRIPTION OF ADDITIONAL PROTECTION	FIRE RESISTANCE (minutes)
Add to the fire-resistance rating of wood stud walls if the spaces between the studs are completely filled with glass fiber mineral wool batts weighing not less than two pounds per cubic foot (0.6 pound per square foot of wall surface) or rockwool or slag material wool batts weighing not less than 3.3 pounds per cubic foot (1 pound per square foot of wall surface), or cellulose insulation having a nominal density not less than 2.6 pounds per cubic foot.	15

For SI: 1 pound/cubic foot = 16.0185 kg/m^3.

721.6.2.4 Floors and Roofs. In the case of a floor or roof, the standard test provides only for testing for fire exposure from below. Except as noted in 780 CMR 703.3, Item 5, floor or roof assemblies of wood framing shall have an upper membrane consisting of a subfloor and finished floor conforming to Table 721.6.2(4) or any other membrane that has a contribution to fire resistance of at least 15 minutes in Table 721.6.2(1).

721.6.2.5 Additional Protection. Table 721.6.2(5) indicates the time increments to be added to the fire resistance where glass fiber, rockwool, slag mineral wool, or cellulose insulation is incorporated in the assembly.

721.6.2.6 Fastening. Fastening of wood frame assemblies and the fastening of membranes to the wood framing members shall be done in accordance with 780 CMR 23.00.

721.6.3 Design of Fire-resistant Exposed Wood Members. The fire-resistance rating, in minutes, of timber beams and columns with a minimum nominal dimension of six inches (152 mm) is equal to:

Equation 7-18

Beams: $2.54Zb\ (4 - 2(b/d))$ for beams which may be exposed to fire on four sides.

Equation 7-19

$2.54Zb\ (4 - (b/d))$ for beams which may be exposed to fire on three sides

Equation 7-20

Columns: $2.54Zd\ (3 - (d/b))$ for columns which may be exposed to fire on four sides

Equation 7-21

$2.54Zd\ (3 - (d/2b))$ for columns which may be exposed to fire on three sides.

where:

b = The breadth (width) of a beam or larger side of a column before exposure to fire (inches).

d = The depth of a beam or smaller side of a column before exposure to fire (inches).

Z = Load factor, based on Figure 720.6.3(1).

K_e = The effective length factor as noted in Figure 721.6.3(2).

l = The unsupported length of columns (inches).

Figure 721.6.3(1)
LOAD FIGURE

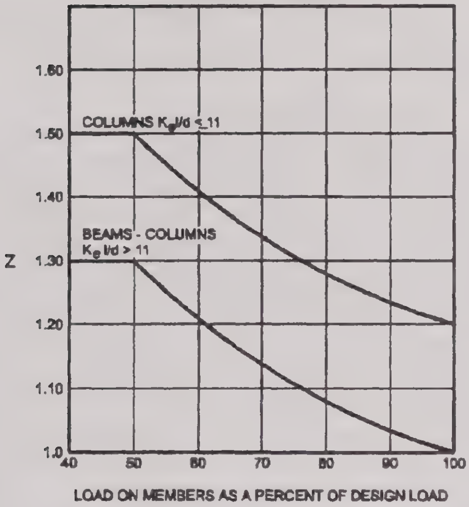
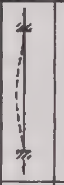
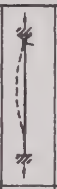
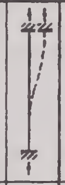
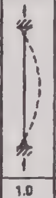
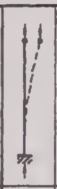
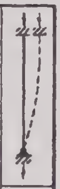
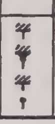


Figure 721.6.3(2)
EFFECTIVE LENGTH FACTORS

BUCKLING MODES						
THEORETICAL K_e VALUE	0.5	0.7	1.0	1.0	2.0	2.0
RECOMMENDED DESIGN K_e WHEN IDEAL CONDITIONS APPROXIMATED	0.65	0.80	1.2	1.0	2.10	2.4
END CONDITION CODE		ROTATION FIXED, TRANSLATION FIXED ROTATION FREE, TRANSLATION FIXED ROTATION FIXED, TRANSLATION FREE ROTATION FREE, TRANSLATION FREE				

721.6.3.1 Equation 7-21. Equation 7-21 applies only where the unexposed face represents the smaller side of the column. If a column is recessed into a wall, its full dimension shall be used for the purpose of these calculations.

721.6.3.2 Allowable Loads. Allowable loads on beams and columns are determined using design values given in ANSI/AF&PA NDS.

721.6.3.3 Fastener Protection. Where minimum one-hour fire resistance is required, connectors and fasteners shall be protected from fire exposure by 1½ inches (38 mm) of wood, or other approved covering or coating for a one-hour rating. Typical details for commonly used fasteners and connectors are shown in AITC Technical Note 7.

721.6.3.4 Minimum Size. Wood members are limited to dimensions of six inches (152 mm) nominal or greater. Glued-laminated timber beams utilize standard laminating combinations except that a core lamination is removed. The tension zone is moved inward and the equivalent of an extra nominal two-inch-thick (51 mm) outer tension lamination is added.

721.7 Other Reference Documents. Refer to 780 CMR 703.3, Item 1, and NBS BMS 71 and NBSTRBM-44 for fire-resistance ratings of materials and assemblies.

NON-TEXT PAGE

780 CMR 8.00

INTERIOR FINISHES

780 CMR 801.0 GENERAL

801.1 Scope. Provisions of 780 CMR 8.00 shall govern the use of materials used as interior finishes, trim and decorative materials.

801.1.1 Interior Finishes. These provisions shall limit the allowable flame spread and smoke development based on location and occupancy classification.

Exceptions:

1. Materials having a thickness less than 0.036 inch (0.9 mm) applied directly to the surface of walls or ceilings.
2. Exposed portions of structural members complying with the requirements for buildings of Type IV construction in 780 CMR 602.4 shall not be subject to interior finish requirements.

801.1.2 Decorative Materials and Trim. Decorative materials and trim shall be restricted by combustibility and flame resistance in accordance with 780 CMR 805.0.

801.1.3 Applicability. For buildings in flood hazard areas as established in 780 CMR 1612.3, interior finishes, trim and decorative materials below the design flood elevation shall be flood-damage-resistant materials.

801.2 Application. Combustible materials shall be permitted to be used as finish for walls, ceilings, floors and other interior surfaces of buildings.

801.2.1 Windows. Show windows in the first story of buildings shall be permitted to be of wood or of unprotected metal framing.

801.2.2 Foam Plastics. Foam plastics shall not be used as interior finish or trim except as provided in 780 CMR 2603.7 or 2604.0.

780 CMR 802.0 DEFINITIONS

802.1 General. The following words and terms shall, for the purposes of 780 CMR 8.00 and as used elsewhere in 780 CMR, have the meanings shown in 780 CMR 802.1.

EXPANDED VINYL WALL COVERING. Wall covering consisting of a woven textile backing, an expanded vinyl base coat layer and a nonexpanded vinyl skin coat. The expanded base coat layer is a homogeneous vinyl layer that contains a blowing agent. During processing, the blowing agent decomposes, causing this layer to expand by forming closed cells. The total thickness of the wall covering is approximately 0.055 inch to 0.070 inch (1.4 mm to 1.78 mm).

FLAME RESISTANCE. That property of materials or combinations of component materials that restricts the spread of flame in accordance with NFPA 701.

FLAME SPREAD. The propagation of flame over a surface.

FLAME SPREAD INDEX. The numerical value assigned to a material tested in accordance with ASTM E 84.

INTERIOR WALL AND CEILING FINISH. The exposed interior surfaces of buildings including, but not limited to: fixed or movable walls and partitions; hanging partitions or banners; columns; ceilings; and interior wainscoting, paneling, or other finish applied structurally or for decoration, acoustical correction, surface insulation, structural fire resistance or similar purposes

INTERIOR FLOOR FINISH. The exposed floor surfaces of buildings including coverings applied over a finished floor or stair, including risers.

INTERIOR WALL AND CEILING FINISH. The exposed interior surfaces of buildings including, but not limited to: fixed or movable walls and partitions; columns; ceilings; and interior wainscotting, paneling or other finish applied structurally or for decoration, acoustical correction, surface insulation, structural fire resistance or similar purposes, but not including trim.

SMOKE-DEVELOPED INDEX. The numerical value assigned to a material tested in accordance with ASTM E 84.

TRIM. Picture molds, chair rails, baseboards, handrails, door and window frames and similar decorative or protective materials used in fixed applications.

780 CMR 803.0 WALL AND CEILING FINISHES

803.1 General. Interior wall and ceiling finishes shall be classified in accordance with ASTM E 84. Such interior finish materials shall be grouped in the following classes in accordance with their flame spread and smoke-developed indexes.

Class A: Flame spread 0-25; smoke-developed 0-450.

Class B: Flame spread 26-75; smoke-developed 0-450.

Class C: Flame spread 76-200; smoke-developed 0-450.

Exception.0 Materials, other than textiles, tested in accordance with 780 CMR 803.2.

803.2. Interior Wall or Ceiling Finishes Other than Textiles. Interior wall or ceiling finishes, other than textiles, shall be permitted to be tested in accordance with NFPA 286. Finishes tested in accordance with NFPA 286 shall comply with 780 CMR 803.2.1.

803.2.1 Acceptance Criteria. During the 40 kW exposure, the interior finish shall comply with 780 CMR 803.2.1 Item 1. During the 160 kW exposure, the interior finish shall comply with780 CMR 803.2.1 Item 2. During the entire test, the interior finish shall comply with 780 CMR 803.2.1 Item 3.

1. During the 40kW exposure, flames shall not spread to the ceiling.
2. During the 160 kW exposure, the interior finish shall comply with the following:
   - 2.1. Flame shall not spread to the outer extremity of the sample on any wall or ceiling.
   - 2.2. Flashover, as defined in NFPA 286, shall not occur.
3. The total smoke released throughout the NFPA 286 test shall not exceed 1,000 m^2.

803.3 Stability. Interior finish materials regulated by 780 CMR 8.00 shall be applied or otherwise fastened in such a manner that such materials will not readily become detached where subjected to room temperatures of 200°F (93°C) for not less than 30 minutes.

803.4 Application. Where these materials are applied on walls, ceilings or structural elements required to have a fire-resistance rating or to be of noncombustible construction, they shall comply with the provisions of 780 CMR.

803.4.1 Direct Attachment and Furred Construction. Where walls and ceilings are required by any provision in 780 CMR to be of fire-resistance-rated or noncombustible construction, the interior finish material shall be applied directly against such construction or to furring strips not exceeding 1.75 inches (44 mm) applied directly against such surfaces. The intervening spaces between such furring strips shall be filled with inorganic or Class A material or shall be fireblocked at a maximum of eight feet (2438 mm) in any direction in accordance with 780 CMR 717.0.

803.4.2 Set-out Construction. Where walls and ceilings are required to be of fire-resistance-rated or noncombustible construction and walls are set out or ceilings are dropped distances greater than specified in 780 CMR 803.4.1, Class A finish materials shall be used except where interior finish materials are protected on both sides by an automatic sprinkler system or attached to noncombustible backing or furring strips installed as specified in 780 CMR 803.4.1. The hangers and assembly members of such dropped ceilings that are below the main ceiling line shall be of noncombustible materials, except that in Type III and V construction, fire-retardant-treated wood shall be permitted. The construction of each set-out wall shall be of fire-resistance-rated construction as required elsewhere in 780 CMR.

803.4.3 Heavy Timber Construction. Wall and ceiling finishes of all classes as permitted in 780 CMR 8.00 that are installed directly against the wood decking or planking of Type IV construction or to wood furring strips applied directly to the wood decking or planking shall be fireblocked as specified in 780 CMR 803.4.1.

803.4.4 Materials. An interior wall or ceiling finish that is not more than 0.25 inch (6.4 mm) thick shall be applied directly against a noncombustible backing.

Exceptions:

1. Class A materials.
2. Materials where the qualifying tests were made with the material suspended or furred out from the noncombustible backing.

803.5 Interior Finish Requirements Based on Group. Interior wall and ceiling finish shall have a flame spread index not greater than that specified in Table 803.5 for the group and location designated. Interior wall and ceiling finish materials, other than textiles, tested in accordance with NFPA 286 and meeting the acceptance criteria of 780 CMR 803.2.1, shall be permitted to be used where a Class A classification in accordance with ASTM E 84 is required.

TABLE 803.5 INTERIOR WALL AND CEILING FINISH REQUIREMENTS BY OCCUPANCY

GROUP	SPRINKLERED[l]			NONSPRINKLERED		
	Vertical exits and exit passageways[a, b]	Exit access corridors and other exitways	Rooms and enclosed spaces[c]	Vertical exits and exit passageways[a, b]	Exit access corridors and other exitways	Rooms and enclosed spaces[c]
A-1 & A-2	B	B	C	A	A[d]	B[e]
A-3[f], A-4, A-5	B	B	C	A	A[d]	C
B, E, M, R-1, R-4	B	C	C	A	B	C
F	C	C	C	B	C	C
H	B	B	C[g]	A	A	B
I-1	B	C	C	A	B	B
I-2	B	B	B[h, i]	A	A	B
I-3	A	A[j]	C	A	A	B
I-4	B	B	B[h, i]	A	A	B
R-2	C	C	C	B	B	C
R-3	C	C	C	C	C	C
S	C	C	C	B	B	C
U	No restrictions			No restrictions		

For SI: 1 inch = 25.4 mm, 1 square foot = 0.0929 m^2.

a. Class C interior finish materials shall be permitted for wainscotting or paneling of not more than 1,000 square feet of applied surface area in the grade lobby where applied directly to a noncombustible base or over furring strips applied to a noncombustible base and fire blocked as required by 780 CMR 803.4.1.

b. In vertical exits of buildings less than three stories in height of other than Group I-3, Class B interior finish for non sprinklered buildings and Class C interior finish for sprinklered buildings shall be permitted.

c. Requirements for rooms and enclosed spaces shall be based upon spaces enclosed by partitions. Where a fire-resistance rating is required for structural elements, the enclosing partitions shall extend from the floor to the ceiling. Partitions that do not comply with this shall be considered enclosing spaces and the rooms or spaces on both sides shall be considered one. In determining the applicable requirements for rooms and enclosed spaces, the specific occupancy thereof shall be the governing factor regardless of the group classification of the building or structure.

d. Lobby areas in A-1, A-2 and A-3 occupancies shall not be less than Class B materials.

e. Class C interior finish materials shall be permitted in places of assembly with an occupant load of 300 persons or less.

f. For churches and places of worship, wood used for ornamental purposes, trusses, paneling or chancel furnishing shall be permitted.

g. Class B material required where building exceeds two stories.

h. Class C interior finish materials shall be permitted in administrative spaces.

i. Class C interior finish materials shall be permitted in rooms with a capacity of four persons or less.

j. Class B materials shall be permitted as wainscotting extending not more than 48 inches above the finished floor in exit access corridors.

k. Finish materials as provided for in other sections of 780 CMR.

l. Applies when the vertical exits, exit passageways, exit access corridors or exit ways, or rooms and spaces are protected by a sprinkler system installed in accordance with 780 CMR 903.3.1.1 or 903.3.1.2.

803.6 Textiles. Where used as interior wall or ceiling finish materials, textiles, including materials having woven or nonwoven, napped, tufted, looped or similar surface, shall comply with the requirements of 780 CMR 803.6.

803.6.1 Textile Wall Coverings. Textile wall coverings shall have a Class A flame spread index in accordance with ASTM E 84 and be protected by automatic sprinklers installed in accordance with 780 CMR 903.3.1.1 or 903.3.1.2 or the covering shall meet the criteria of 780 CMR 803.6.1.1 or 803.6.1.2 when tested in the manner intended for use in accordance with NFPA 265 using the product mounting system, including adhesive.

803.6.1.1 Method A Test Protocol. During the Method A protocol, flame shall not spread to the ceiling during the 40 kW exposure. During the 150 kW exposure, the textile wall covering shall comply with all of the following:

1. Flame shall not spread to the outer extremity of the sample on the 8-foot by 12-foot (203 mm by 305 mm) wall.
2. The specimen shall not burn to the outer extremity of the two-foot-wide (610 mm) samples mounted in the corner of the room.
3. Burning droplets deemed capable of igniting textile wall coverings or that burn for 30 seconds or more shall not form.
4. Flashover, as defined in NFPA 265, shall not occur.

5. The maximum net instantaneous peak heat release rate, determined by subtracting the burner output from the maximum heat release rate, does not exceed 300 kW.

803.6.1.2 Method B Test Protocol. During the Method B protocol, flames shall not spread to the ceiling at any time during the 40 kW exposure. During the 150 kW exposure, the textile wall covering shall comply with the following:

1. Flame shall not spread to the outer extremities of the samples on the 8-foot by 12-foot (203 mm by 305 mm) walls.
2. Flashover, as described in NFPA 265, shall not occur.

803.6.2 Textile Ceiling Finish. Where used as a ceiling finish, carpet and similar textile materials shall have a Class A flame spread index in accordance with ASTM E 84 and be protected by automatic sprinklers.

803.7 Expanded Vinyl Wall Coverings. Expanded vinyl wall coverings shall comply with the requirements for textile wall and ceiling materials and their use shall comply with 780 CMR 803.6.

Exception: Expanded vinyl wall or ceiling coverings complying with 780 CMR 803.2 shall not be required to comply with 780 CMR 803.1 or 803.6.

803.8 Insulation. Thermal and acoustical insulation shall comply with 780 CMR 719.0.

803.9 Acoustical Ceiling Systems. The quality, design, fabrication and erection of metal suspension systems for acoustical tile and lay-in panel ceilings in buildings or structures shall conform with generally accepted engineering practice, the provisions of 780 CMR 8.00 and other applicable requirements of 780 CMR.

803.9.1 Materials and Installation. Acoustical materials complying with the interior finish requirements of 780 CMR 803 shall be installed in accordance with the manufacturer's recommendations and applicable provisions for applying interior finish.

803.9.1.1 Suspended Acoustical Ceilings. Suspended acoustical ceiling systems shall be installed in accordance with the provisions of ASTM C 635 and ASTM C 636.

803.9.1.2 Fire-resistance-rated Construction. Acoustical ceiling systems that are part of fire-resistance-rated construction shall be installed in the same manner used in the assembly tested and shall comply with the provisions of 780 CMR 7.00.

780 CMR 804.0 INTERIOR FLOOR FINISH

804.1 General. Interior floor finish and floor covering materials shall comply with 780 CMR 804.0.

Exception: Floors and floor coverings of a traditional type, such as wood, vinyl, linoleum or terrazzo, and resilient floor covering materials which are not comprised of fibers.

804.2 Classification. Interior floor finish and floor covering materials required by 780 CMR 804.5.1 to be of Class I or II materials shall be classified in accordance with NFPA 253. The classification referred to herein corresponds to the classifications determined by NFPA 253 as follows: Class I, 0.45 watts/cm^2 or greater; Class II, 0.22 watts/cm^2 or greater.

804.3 Testing and Identification. Floor covering materials shall be tested by an approved agency in accordance with NFPA 253 and identified by a hang tag or other suitable method so as to identify the manufacturer or supplier and style, and shall indicate the interior floor finish or floor covering classification according to 780 CMR 804.2. Carpet-type floor coverings shall be tested as proposed for use, including underlayment. Test reports confirming the information provided in the manufacturer's product identification shall be furnished to the building official upon request.

804.4 Application. Combustible materials installed in or on floors of buildings of Type I or II construction shall conform with the requirements of 780 CMR 804.4.

Exception: Stages and platforms constructed in accordance with 780 CMR 410.3 and 410.4, respectively.

804.4.1 Subfloor Construction. Floor sleepers, bucks and nailing blocks shall not be constructed of combustible materials, unless the space between the fire-resistance-rated floor construction and the flooring is either solidly filled with approved noncombustible materials or fireblocked in accordance with 780 CMR 717.0, and provided that such open spaces shall not extend under or through permanent partitions or walls.

804.4.2 Wood Finish Flooring. Wood finish flooring is permitted to be attached directly to the embedded or fireblocked wood sleepers and shall be permitted where cemented directly to the top surface of approved fire-resistance-rated construction or directly to a wood subfloor attached to sleepers as provided for in 780 CMR 804.4.1.

804.4.3 Insulating Boards. Combustible insulating boards not more than 0.5-inch (12.7 mm) thick and covered with approved finished flooring are permitted, where attached directly to a noncombustible floor assembly or to wood subflooring attached to sleepers as provided for in 780 CMR 804.4.1.

804.5 Interior Floor Finish Requirements. In all occupancies, interior floor finish in vertical exits, exit passageways, exit access corridors and rooms or spaces not separated from exit access corridors by full-height partitions extending from the floor to the underside of the ceiling shall withstand a minimum critical radiant flux as specified in 780 CMR 804.5.1.

804.5.1 Minimum Critical Radiant Flux. Interior floor finish in vertical exits, exit passageways and exit access corridors shall not be less than Class I in Groups I-2 and I-3 and not less than Class II in Groups A, B, E, H, I- 4, M, R-1, R-2 and S. In all other areas, the interior floor finish shall comply with the DOC FF-1 "pill test" (CPSC 16 CFR, Part 1630).

Exception: Where a building is equipped throughout with an automatic sprinkler system in accordance with 780 CMR 903.3.1.1, Class II materials are permitted in any area where Class I materials are required and materials complying with DOC FF-1 "pill test" (CPSC 16 CFR, Part 1630) are permitted in any area where Class II materials are required.

780 CMR 805.0 DECORATIONS AND TRIM

805.1 General. In all occupancies, curtains, draperies, hangings and other decorative materials suspended from walls or ceilings shall satisfy all applicable requirements of 527 CMR.

805.1.1 Noncombustible Materials. The permissible amount of noncombustible decorative material shall not be limited.

805.1.2 Flame-resistant Materials. Reserved.

805.2 Acceptance Criteria and Reports. Reserved

805.3 Foam Plastic. Foam plastic used as trim in any occupancy shall comply with 780 CMR 2604.2.

***Exception: Foam plastics utilized in A-2nc Uses are subject to** 780 CMR 26.00*

805.4 Pyroxylin Plastic. Imitation leather or other material consisting of or coated with a pyroxylin or similarly hazardous base shall not be used in Group A occupancies.

805.5 Trim. Material used as interior trim shall have minimum Class C flame spread and smoke-developed indexes. Combustible trim, excluding handrails and guardrails, shall not exceed 10% of the aggregate wall or ceiling area in which it is located.

NON-TEXT PAGE

780 CMR 9.00

FIRE PROTECTION AND LIFE SAFETY SYSTEMS

780 CMR 9.00 is unique to Massachusetts

780 CMR 901.0 GENERAL

901.1 Scope. The provisions of 780 CMR 9.00 shall specify where *fire protection systems* are required and shall apply to the design, installation, maintenance and operation of all *fire systems* in all buildings and structures.

901.1.1 Seismic Requirements. All "required" and "non-required" fire protection systems shall be installed in accordance with the applicable Seismic Criteria requirements of 780 CMR 1613, related to the seismic design of fire protection systems.

901.2 Required Systems. All *fire protection systems* required by 780 CMR shall be installed, repaired, operated and maintained in accordance with 780 CMR 9.00 and the applicable reference standards listed in ***780 CMR 35.00***. All required *fire suppression* and *standpipe systems* shall be provided with at least one automatic supply of fire-extinguishing agent of adequate pressure, capacity and reliability to perform the function intended.

901.3 Nonrequired Systems. Any *fire protection system or* portion thereof not required by 780 CMR shall be permitted to be installed for partial or complete protection provided that such installed system meets applicable requirements of 780 CMR. A building permit shall be required for systems installed pursuant to 780 CMR 901.3.

901.4 Maintenance. All water based fire protection systems shall be maintained in accordance with NFPA 25 as listed in ***780 CMR 35.00***. All other *fire protection systems* shall be maintained in accordance with the requirements of the applicable reference standards and standards listed in ***780 CMR 35.00***. The owner of every building or structure shall be responsible for the care and maintenance of all fire protection systems, including equipment and devices, to ensure the safety and welfare of the occupants. No person shall shut off, disconnect, obstruct, remove or destroy, or cause or permit to be shut off, disconnected, obstructed, removed or destroyed, any part of any sprinkler system, water main, hydrant or other device used for fire protection or carbon monoxide detection and alarm in any building owned, leased or occupied by such person or under his control or supervision, without first procuring a written permit so to do from the head of the fire department of the city or town wherein such building is situated in accordance with M.G.L. c. 148, § 27A.

When installations of fire protection systems are interrupted for repairs or other necessary reasons, the owner, tenant or lessee shall immediately advise the local fire department and shall diligently prosecute the restoration of the protection.

901.5 Threads. All threads provided for fire department connections to *sprinkler systems, standpipes*, yard hydrants or any other fire hose connection shall be compatible with the connections used by the local fire department.

901.6 Signs-general. All signs required to identify fire protection equipment, equipment rooms and equipment locations shall be constructed of durable materials, be permanently installed and be readily visible. Letters and numbers shall contrast with the sign background, shall be at least two inches in height and shall have an appropriate width-to-height ratio to permit the sign to be read easily from a distance of ten feet. The sign and location shall be approved by the local fire department.

901.6.1 Sprinkler Control Valve Room Signage. Where sprinkler control valves are located in a separate room or building, a sign shall be provided on the entrance door. The lettering shall be at least 2½ inches (63.5 mm) in height and shall otherwise conform to 780 CMR 901.6 and shall read "Sprinkler Control Valves."

901.6.2 Fire Department Connections Signage. A metal sign with raised letters at least one inch (25 mm) in height shall be mounted on all fire department connections serving *sprinklers* or *standpipes*. Such signs shall read "Automatic Sprinklers" or "Standpipe," or both, as applicable.

901.7 Fire Protection Systems Approval/ Acceptance.

901.7.1 Required. Complete *fire protection construction documents* shall be submitted in accordance with 780 CMR 110.0 and 780 CMR 901.0 and a building permit obtained prior to the installation of all "required" or "non required" fire protection systems, including *modifications, alterations, additions or deletions* to an existing fire protection system. The *fire protection construction documents* shall contain sufficient information to completely describe the *fire protection systems*, including operational features. The information required pursuant to 780 CMR 901.7 shall include, where required, the items listed in 780 CMR 901.7.1.1.

Exceptions:

1. *Maintenance*; no building permit required.
2. For modifications, alterations, additions or deletions which do not affect system performance or compatibility; no building permit is

required unless otherwise directed by the Building Official. (Note also refer to M.G.L. c. 148, § 27A and M.G.L. c. 148, § 10A.)

901.7.1.1 Fire Protection Construction Documents.

1. a. Basis (methodology) of design for the protection of the occupancy and hazards for compliance with 780 CMR and applicable NFPA Standards, in the form of a narrative report.
   b. Sequence of operation of all fire protection systems and operation in the form of a narrative report.
   c. Testing criteria to be used for final system acceptance in the form of a narrative report.
2. Building and site access for fire fighting and/or rescue vehicle(s) and personnel.
3. Fire hydrant(s) location and water supply information.
4. Type/description and design layout of the automatic sprinkler system(s).
5. Automatic sprinkler system(s) control equipment location.
6. Type/description and design layout of the automatic standpipe system(s).
7. Standpipe system hose valve(s) type and location.
8. Fire department siamese connection type(s) and location.
9. Type/description and design layout of the fire protective signaling system(s).
10. Fire protective signaling system(s) control equipment and remote annunciator location.
11. Type/description and design layout of the smoke control or exhaust system(s).
12. Smoke control or exhaust system(s) control equipment location.
13. Building life safety system features (auxiliary functions) required to be integrated as part of the fire protective signaling system(s).
14. Type/description and design layout of the fire extinguishing system(s).
15. Fire extinguishing system(s) control equipment location.
16. Fire protection system(s) equipment room location.
17. Fire protection system(s) equipment identification and operation signs.
18. Fire protection system(s) alarm/ supervisory signal transmission method and location.
19. Fire command center location.
20. Type/description and location of any emergency alarm system.
21. Type/description and location of any carbon monoxide protection.

901.7.1.2 Plans. All fire protection system plans shall contain sufficient information to identify the occupancy, hazards, system and equipment arrangements, system and equipment sizing, systems specifications, systems sequence(s) of operation and design/engineering calculations.

901.7.1.3 Design. All fire protection systems and fire protection system operation including building and site features as identified in 780 CMR 901.7.1.1 shall be designed and specified by a qualified *Registered Professional Engineer(s)* except as provided in M.G.L. c. 143, § 54A and any profession or trade as provided in M.G.L. c. 112, § 60L and M.G.L. c. 112, § 81R. All plans shall bear the original seal and signature of the *Registered Professional Engineer(s)*, except as provided in M.G.L. c. 143, § 54A and any profession or trade as provided in M.G.L. c. 112, § 60L and M.G.L. c. 112, § 81R. Specifications shall include requirements for the preparation of shop drawings when required by 780 CMR or applicable NFPA Standards. The *Registered Professional Engineer(s)* or other *legally recognized professional* (M.G.L. c. 112, § 81R) *shall* be responsible for the review and certify that all shop drawings conform to the approved fire protection *construction documents* as submitted for the building permit and approved by the building official.

901.7.1.4 As-built Plans. As built plans shall be provided to the building owner for all fire protection and life safety systems that are sealed as reviewed and approved by the registered Professional Engineer or legally recognized professional performing Construction Control. Where changes to original shop drawings are minor, a list of as-built changes shall be permitted to be submitted where sealed and reviewed and approved by the registered Professional Engineer or legally recognized professional performing Construction Control.

901.7.1.5 Safeguarding Construction. The *fire protection construction documents* shall provide specifications for conformance to 780 CMR 33.00 and NFPA-241 listed in ***780 CMR 35.00*** in order to safeguard against fires during construction, alterations and demolition of all buildings and structures regulated by 780 CMR.

901.7.2 Authority. In accordance with the requirements of 780 CMR 110.0 and 780 CMR 901.7.1 the building of official shall transmit one set of the *fire protection construction documents* (780 CMR 901.7.1.1) and *building construction documents* to the head of the fire department or his designee for review and approval of the items specified in 780 CMR 901.7.1.1.

Notes:

1. M.G.L. c. 148 §§ 26G, 26G.5, 26H and 26I, as applicable or otherwise when adopted by a city or town, will impact the fire protection requirements of 780 CMR 9.00. A building official shall consult *Official Interpretation* Number 45-96, for guidance, where communities have adopted M.G.L. c. 148, §§ 26G, 26H, and/or 26I.
2. In addition to the building permit requirements for fire protection systems in 780 CMR, M.G.L. c. 148, § 10A and 527 CMR may impose additional installation permitting requirements.

901.7.2.1 Alternative Fire Protection Design Methodologies - Independent Engineering Review. Where alternative design methodologies are utilized and where such methodologies result in designs which vary from any prescriptive requirement of 780 CMR, the owner shall engage an independent registered professional engineer to review said alternative design methodologies. The scope of the independent registered professional engineer review shall include, but not be limited to the following;

(a) Review of the design assumptions, methodologies and resulting proposed system designs, to determine whether the proposed fire protection system designs and any other systems which are affected by the design assumptions, are consistent with the general objectives and prescriptive provisions of 780 CMR and to determine whether or not the methodologies and assumptions conform to accepted engineering practice;

(b) Preparation of a written report to the building official as to the appropriateness of the proposed design, specifically listing any variances from the prescriptive provisions of 780 CMR and describing, in detail, the design provisions used to achieve compliance.

If the reviewing engineer concurs with the proposed design, the owner shall make application for a variance, to the State Building Code Appeals Board as provided in 780 CMR 122.0. In addition to all supporting information and materials, the reviewing engineer's report required in 780 CMR 901.7.2.1(b) shall be included in the application for variance.

A building permit shall not be issued until the variance, if required, has been granted, or unless the building permit is issued in part, as provided for in 780 CMR 111.13. When a variance is granted under 780 CMR 901.0 for a bulk merchandising retail building as defined in 780 CMR 424.2.1, and when the condition appealed is common to future buildings of the owner, the State Building Code Appeals Board, upon request of the owner, may provide that the variance shall be applicable to such future buildings. If such request is made, a quorum of the Board shall hear the appeal. Each such applicability to a future building will be subject to determination as prescribed in 780 CMR 110.8 by the building official in conjunction with the head of the local fire department that its use is in conformity with the terms of the variance.

901.7.3 Fire Protection Systems Installation. Fire protection systems shall be installed by contractors and personnel appropriately licensed in the Commonwealth of Massachusetts (***licensed installing contractor***). Shop drawings required for submittals and reviews by the *Registered Professional Engineer*, or other *legally recognized professional* by 780 CMR 901.7.1.3 or by applicable NFPA Standards shall note the name(s), license number(s) and license expiration date(s) of the contractor(s) installing the fire protection systems.

901.7.4 Acceptance. In accordance with the provisions of 780 CMR 120.0, a Certificate of Occupancy shall not be issued until the building official and the head of the fire department or their designees have witnessed a satisfactory functional test of all *fire protection systems,* installed in accordance with the approved *fire protection construction documents.* All fire protection systems shall be tested in accordance with the applicable provisions of 780 CMR and NFPA Standards and approved testing criteria and operational sequence as submitted in 780 CMR 901.7.1.1, items 1.b and c. In addition, the following documents and/or information shall be simultaneously submitted to the building official and head of the fire department or their designees prior to the witnessing of the operational fire protection system(s) testing:

1. Certification, from the *Registered Professional Engineer* or other *legally recognized professional* responsible for the design in accordance with 780 CMR 901.7.1.3 stating that the fire protection systems have been installed in accordance with the approved *fire protection construction* documents and that he has reviewed the shop drawings for conformance to 780 CMR 901.7.3 and has identified deviations if any, from the approved *fire protection construction documents.*
2. Confirmation by the building owner/developer or authorized representative that they have received the as-built fire protection system shop drawings from the *installing contractor* and that *the Registered Professional Engineer* or other *legally recognized profes-*

sional (M.G.L. c. 112, § 81R) has certified their reasonable accuracy.

3. Material, Test, Performance and Completion Certificates, properly executed by the *installing contractor* in accordance with the applicable NFPA Standards.

Exception. In lieu of witnessing a satisfactory functional test, the building official and head of the fire department or their designees may accept a final performance acceptance test report from a *Registered Professional Engineer* or other *legally recognized professional*. Said report shall certify that a complete satisfactory functional test of all fire protection systems in accordance with the approved testing criteria and operational sequence have been witnessed.

901.7.4.1 Conditional Acceptance. The requirements of 780 CMR 901.7.4 shall not preclude the issuance of a temporary Certificate of occupancy by the Building Official in accordance with 780 CMR 120.3.

780 CMR 902.0 DEFINITIONS

902.1 Definitions. The following words and terms shall, for the purposes of 780 CMR 9.00, and as used elsewhere in 780 CMR, have the meanings shown in 780CMR 902.1.

ALARM NOTIFICATION APPLIANCE. A fire alarm system component such as a bell, horn, speaker, light or text display that provides audible, tactile or visible outputs, or any combination thereof.

ALARM SIGNAL. A signal indicating an emergency requiring immediate action, such as a signal indicative of fire.

ALARM VERIFICATION FEATURE. A feature of automatic fire detection and alarm systems to reduce unwanted alarms wherein smoke detectors report alarm conditions for a minimum period of time, or confirm alarm conditions within a given time period, after being automatically reset, in order to be accepted as a valid alarm-initiation signal.

ANNUNCIATOR. A unit containing one or more indicator lamps, alphanumeric displays or other equivalent means in which each indication provides status information about a circuit, condition or location.

APPROVAL/PERMIT TO INSTALL. Permits outside the jurisdiction of the building official, issued under authority of M.G.L. c. 148, §10A or 527 CMR.

AUDIBLE ALARM NOTIFICATION APPLIANCE. A notification appliance that alerts by the sense of hearing.

AUTHORITY HAVING JURISDICTION. The term "Authority Having Jurisdiction" as used in the NFPA Standards as referenced in 780 CMR 9.00, shall mean the building official for enforcement of 780 CMR and the BBRS for interpretation, waiver or variances (see 780 CMR 122.0; see official interpretation number 35-94).

AUTOMATIC. As applied to fire protection devices, is a device or system providing an emergency function without the necessity for human intervention and activated as a result of a predetermined temperature rise, rate of temperature rise or combustion products.

AUTOMATIC FIRE-EXTINGUISHING SYSTEM. An approved system of devices and equipment which automatically detects a fire and discharges an approved fire-extinguishing agent onto or in the area of a fire.

AUTOMATIC SPRINKLER SYSTEM. A sprinkler system, for fire protection purposes, is an integrated system of underground and overhead piping designed in accordance with fire protection engineering standards. The system includes a suitable automatic water supply. The portion of the system above the ground is a network of specially sized or hydraulically designed piping installed in a structure or area, generally overhead, and to which automatic sprinklers are connected in a systematic pattern. The system is usually activated by heat from a fire and discharges water over the fire area.

AVERAGE AMBIENT SOUND LEVEL. The root mean square, A-weighted sound pressure level measured over a 24-hour period.

BAR. An occupancy offering services primarily for alcoholic beverages with limited food service.

CARBON DIOXIDE EXTINGUISHING SYSTEMS. A system supplying carbon dioxide (CO_2) from a pressurized vessel through fixed pipes and nozzles. The system includes a manual- or automatic-actuating mechanism.

CARBON MONOXIDE ALARM PROTECTION. A system comprising of listed devices that respond to carbon monoxide and provides an alarm signal to notify occupants.

CEILING LIMIT. The maximum concentration of an air-borne contaminant to which one may be exposed, as published in DOL 29 CFR Part 1910.1000.

CLEAN AGENT. Electrically nonconducting, volatile or gaseous fire extinguishant that does not leave a residue upon evaporation.

CONSTANTLY ATTENDED LOCATION. A designated location at a facility staffed by trained personnel on a continuous basis where alarm or supervisory signals are monitored and facilities are provided for notification of the fire department or other emergency services.

CONSTRUCTION DOCUMENTS. See 780 CMR 202.0, CONSTRUCTION DOCUMENTS.

DELUGE SYSTEM. A sprinkler system employing open sprinklers attached to a piping system connected to a water supply through a valve that is opened by the operation of a detection system installed in the same areas as the sprinklers. When this valve opens, water flows into the piping system and discharges from all sprinklers attached thereto.

DETECTOR, HEAT. A fire detector that senses heat produced by burning substances. Heat is the energy produced by combustion that causes substances to rise in temperature.

DRY-CHEMICAL EXTINGUISHING AGENT. A powder composed of small particles, usually of sodium bicarbonate, potassium bicarbonate, urea-potassium-based bicarbonate, potassium chloride or monoammonium phosphate, with added particulate material supplemented by special treatment to provide resistance to packing, resistance to moisture absorption (caking) and the proper flow capabilities.

EMERGENCY ALARM SYSTEM. A system to provide indication and warning of emergency situations involving hazardous materials.

EMERGENCY VOICE/ALARM COMMUNICATIONS. Dedicated manual or automatic facilities for originating and distributing voice instructions, as well as alert and evacuation signals pertaining to a fire or other emergency, to the occupants of a building.

EXPLOSION. An effect produced by the sudden violent expansion of gases, that is accompanied by a shock wave or disruption of enclosing materials or structures, or both.

FIRE ALARM BOX, MANUAL. See "Manual Fire Alarm Box."

FIRE ALARM CONTROL UNIT. A system component that receives inputs from automatic and manual fire alarm devices and is capable of supplying power to detection devices and transponder(s) or off-premises transmitter(s). The control unit is capable of providing a transfer of power to the notification appliances and transfer of condition to relays or devices.

FIRE ALARM SIGNAL. A signal initiated by a fire alarm-initiating device such as a manual fire alarm box, automatic fire detector, water flow switch, or other device whose activation is indicative of the presence of a fire or fire signature.

FIRE ALARM SYSTEM. A system or portion of a combination system consisting of components and circuits arranged to monitor and annunciate the status of fire alarm or supervisory signal-initiating devices and to initiate the appropriate response to those signals.

FIRE COMMAND CENTER. The principal attended or unattended location where the status of detection, alarm communications and control systems is displayed, and from which the system(s) can be manually controlled.

FIRE DEPARTMENT DESIGNEE. An individual authorized by the chief of the fire department to review and approve fire protection system plans and installation.

FIRE DETECTOR, AUTOMATIC. A device designed to detect the presence of a fire signature and to initiate action.

FIRE PROTECTION SYSTEM. Approved devices, equipment and systems or combinations of systems used to detect a fire, activate an alarm, extinguish or control a fire, control or manage smoke and products of a fire or any combination thereof.

FIRE SAFETY FUNCTIONS. Building and fire control functions that are intended to increase the level of life safety for occupants or to control the spread of harmful effects of fire.

FOAM-EXTINGUISHING SYSTEM. A special system discharging a foam made from concentrates, either mechanically or chemically, over the area to be protected.

HALOGENATED EXTINGUISHING SYSTEM. A fire-extinguishing system using one or more atoms of an element from the halogen chemical series: fluorine, chlorine, bromine and iodine.

HEAT DETECTOR. A fire detector that senses heat produced by burning substances. Heat is the energy produced by combustion that causes substances to rise in temperature.

HOUSEHOLD FIRE WARNING SYSTEM. A household fire warning system consists of single or multiple station detectors or a listed control unit with automatic fire detectors and occupant notification appliances. The household fire warning system serves only one dwelling unit, patient room, hotel room or other single area depending on use group requirements.

INITIATING DEVICE. A system component that originates transmission of a change-of-state condition, such as in a smoke detector, manual fire alarm box or supervisory switch.

INSTALLING CONTRACTOR. An individual or firm duly licensed to install fire protection systems. (See 780 CMR 901.7.3)

- Automatic Sprinklers Systems - M.G.L. c. 146, §§ 81 through 85A, 528 CMR 11.00 and 12.00.

- Fire Extinguishing systems - M.G.L. c. 148, §§ 58, 527 CMR 23.00.

- Fire Alarm Systems - M.G.L. c. 141, §§ 1 through 10, 237 CMR 1.00 through 6.00.

LEGALLY RECOGNIZED PROFESSIONAL. Those recognized under M.G.L. c. 112,§ 81R including a person, firm, partnership, corporation or association who prepare plans, specifications or shop drawings for work to be installed by the same person, firm, partnership, corporation or association preparing such plans, specifications or shop drawings.

LIMITED AREA, SPRINKLER SYSTEM. An automatic sprinkler system consisting of not more than 20 sprinklers (see 780 CMR 903.3.5.1.1).

LISTED. Equipment, materials or services included in a list published by an organization acceptable to the building official and concerned with evaluation of products or services that maintains periodic inspection of production of listed equipment or materials or periodic evaluation of services and whose listing states either that the equipment, material or service meets identified standards or has been tested and found suitable for a specified purpose.

MAINTENANCE OF FIRE PROTECTION SYSTEMS. Replacement or repair of any component or components of a fire protection system, where such does not affect system performance and compatibility. (Also see Modifications, Alterations, Additions or Deletions to Fire Protection Systems). No building permit is required for maintenance. Other permits, however, may be required pursuant to M.G.L. c.148, § 27A and 527 CMR.

MANUAL FIRE ALARM BOX. A manually operated device used to initiate an alarm signal.

MASTER BOX. A municipal fire alarm box that may also be operated by remote means.

MODIFICATIONS, ALTERATIONS, ADDITIONS OR DELETIONS TO FIRE PROTECTION SYSTEMS. Any changes which affect the performance of the fire protection system. (Also see maintenance). Such changes require a building permit and are subject to other permitting requirements pursuant to M.G.L. c. 148, § 27A.

MULTIPLE-STATION ALARM DEVICE. Two or more single-station alarm devices that are capable of interconnection such that actuation of one causes all integral or separate audible alarms to operate. It also can consist of one single-station alarm device having connections to other detectors or to a manual fire alarm box.

MULTIPLE-STATION SMOKE ALARM. Two or more single-station alarm devices that are capable of interconnection such that actuation of one causes all integral or separate audible alarms to operate.

MUNICIPAL FIRE ALARM SYSTEM. A system of alarm initiating devices, receiving equipment, and connecting circuits (other than a public telephone network) used to transmit alarms from street locations to the public fire service communications center.

NIGHTCLUB. An occupancy characterized by any of the following: no theatrical stage accessories other than raised platform; low lighting levels; entertainment by a live band or recorded music generating above-normal sound levels; later-than-average operating hours; tables and seating arranged or positioned so as to create ill defined aisles; a specific area designated for dancing; service facilities primarily for alcoholic beverages with limited food service; and high occupant load density. A nightclub may not include occupancies used for organized private dining events with the following characteristics: used for events that feature a meal as the primary attraction; used for events that are organized for the purpose of a private function, attendance for each specific event is limited and pre-arranged between the facility operator and the private event organizers, the number of guests is limited by written invitation or limited ticket availability and does not exceed the agreed upon attendance limit; each event has a definite starting and ending time; tables and chairs are arranged in well-defined aisles in such a manner to not impede easy egress; there are no significantly low lighting levels; the maximum documented legal capacity, based upon the available floor space, is not less than 15 feet (net) per occupant; the characteristics of events are strictly controlled by an on-site manager and are made part of a written function event contract."

NUISANCE ALARM. An alarm caused by mechanical failure, malfunction, improper installation or lack of proper maintenance, or an alarm activated by a cause that cannot be determined.

PRE-ACTION SYSTEMS. A fire sprinkler system employing automatic sprinklers attached to a piping system containing air with a supplemental fire detection system installed in the same areas as the Actuation of the fire detection system automatically opens a valve that permits water to flow into the sprinkler piping system and to be discharged from any open sprinklers.

PROPRIETARY SUPERVISING STATION. Refer to the definition in NFPA-72 and to further details as identified in NFPA-72 as listed in 780 CMR 35.00.

RECORD DRAWINGS. Drawings ("as builts") that document the location of all devices, appliances, wiring sequences, wiring methods and connections of the components of a fire alarm system as installed.

REGISTERED PROFESSIONAL ENGINEER. A Registered Professional Engineer registered by the Board of Registration of Professional Engineers and of Land Surveyors in accordance with M.G.L. c. 112, §§ 81D through 81T and 250 CMR.

REMOTE STATION FIRE ALARM SYSTEM SUPERVISING STATION. Refer to the definitions in NFPA-72 and to further details as identified in NFPA-72 as listed in 780 CMR 35.00.

SINGLE-STATION SMOKE ALARM. An assembly incorporating the detector, the control equipment and the alarm-sounding device in one unit, operated from a power supply either in the unit or obtained at the point of installation.

SHOP DRAWINGS. Scaled detailed working drawings (system layout) and equipment specifications (cut sheets) indicating all information in accordance with requirements of the applicable NFPA Standards for the specific fire protection systems to be installed in accordance with the plans and specifications prepared by a *Registered Professional Engineer* or *Legally Recognized Professional*.

SMOKE ALARM. A single- or multiple-station alarm responsive to smoke and not connected to a system.

SMOKE DETECTOR. A listed device that senses visible or invisible particles of combustion.

SMOKEPROOF ENCLOSURE. An exit stairway designed and constructed so that the movement of the products of combustion produced by a fire occurring in any part of the building into the enclosure is limited.

SPRINKLER. A device, connected to a water supply system, that discharges water in a specific pattern for extinguishment or control of fire.

STANDPIPE SYSTEM, CLASSES OF. Standpipe classes are as follows:

Class I System. A system providing 2.5-inch (64 mm) hose connections to supply water for use by fire departments and those trained in handling heavy fire streams.

Class II System. A system providing 1.5-inch (38 mm) hose stations to supply water for use primarily by the building occupants or by the fire department during initial response.

Class III System. A system providing 1.5-inch (38 mm) hose stations to supply water for use by building occupants and 2.5-inch (64 mm) hose connections to supply a larger volume of water for use by fire departments and those trained in handling heavy fire streams.

STANDPIPE, TYPES OF. Standpipe types are as follows:

Automatic Dry. A dry standpipe system, normally filled with pressurized air, that is arranged through the use of a device, such as dry pipe valve, to admit water into the system piping automatically upon the opening of a hose valve. The water supply for an automatic dry standpipe system shall be capable of supplying the system demand.

Automatic Wet. A wet standpipe system that has a water supply that is capable of supplying the system demand automatically.

Manual Dry. A dry standpipe system that does not have a permanent water supply attached to the system. Manual dry standpipe systems require water from a fire department pumper to be pumped into the system through the fire department connection in order to meet the system demand.

Manual Wet. A wet standpipe system connected to a water supply for the purpose of maintaining water within the system but does not have a water supply capable of delivering the system demand attached to the system. Manual-wet standpipe systems require water from a fire department pumper (or the like) to be pumped into the system in order to meet the system demand.

Semiautomatic Dry. A dry standpipe system that is arranged through the use of a device, such as a deluge valve, to admit water into the system piping upon activation of a remote control device located at a hose connection. A remote control activation device shall be provided at each hose connection. The water supply for a semiautomatic dry standpipe system shall be capable of supplying the system demand.

SUPERVISING STATION. A facility that receives signals and at which personnel are in attendance at all times to respond to these signals.

SUPERVISORY SERVICE. The service required to monitor performance of guard tours and the operative condition of fixed suppression systems or other systems for the protection of life and property.

SUPERVISORY SIGNAL. A signal indicating the need of action in connection with the supervision of guard tours, the fire suppression systems or equipment or the maintenance features of related systems.

SUPERVISORY SIGNAL-INITIATING DEVICE. An initiation device, such as a valve supervisory switch, water-level indicator or low-air pressure switch on a dry-pipe sprinkler system, whose change of state signals an off-normal condition and its restoration to normal of a fire protection or life safety system, or a need for action in connection with guard tours, fire suppression systems or equipment or maintenance features of related systems.

TIRES, BULK STORAGE OF. Storage of tires where the area available for storage exceeds 20,000 cubic feet (566 m^3).

TROUBLE SIGNAL. A signal initiated by the fire alarm system or device indicative of a fault in a monitored circuit or component.

U.L. LISTED OR FM APPROVED CENTRAL STATION SERVICE. Central station service as defined in NFPA-72 and as further identified in NFPA 72 as listed in 780 CMR 35.00.

VISIBLE ALARM NOTIFICATION APPLIANCE. A notification appliance that alerts by the sense of sight.

WATER SUPPLY AUTOMATIC. A water supply that is not dependent on any manual operation, such as making connections, operating valves or starting pumps.

WET-CHEMICAL EXTINGUISHING SYSTEM. A solution of water and potassium-carbonate-based chemical, potassium-acetate-based chemical or a combination thereof, forming an extinguishing agent.

WIRELESS PROTECTION SYSTEM. A system or a part of a system that can transmit and receive signals without the aid of wire.

ZONE. A defined area within the protected premises. A zone can define an area from which a signal can be received, an area to which a signal can be sent or an area in which a form of control can be executed.

780 CMR 903.0 AUTOMATIC SPRINKLER SYSTEMS

903.1 General. Automatic sprinkler systems shall comply with 780 CMR 903.0.

903.1.1 Sprinklered Throughout. Sprinklered throughout shall mean sprinkler protection in all areas required by the applicable design and installation automatic fire sprinkler standard and 780 CMR.

903.2 Where Required. Automatic sprinkler systems in buildings and structures shall be provided in the locations described in 780 CMR 903.0. (Also see Note 1.)

Exceptions:

1. Any room where the application of water, or flame and water, constitutes a serious life or fire hazard and protected by an alternative automatic fire-extinguishing system in accordance with 780 CMR 903.1.1.
2. Spaces or areas in telecommunications buildings used exclusively for telecommunications equipment, associated electrical power distribution equipment, batteries and standby engines, provided those spaces or areas are equipped throughout with an automatic fire alarm system in accordance with 780 CMR 907.0 and are separated from the remainder of the building by a wall with a fire-resistance rating of not less than one hour and a floor/ceiling assembly with a fire-resistance rating of not less than two hours.
3. Portions of buildings that comply with 780 CMR 406.0 for open parking structures less than 70 feet in height above mean grade.
4. Automatic sprinkler protection shall not be provided in:
   (a) elevator machine rooms of traction/drum elevators;
   (b) elevator machine rooms of hydraulic elevators;
   (c) elevator hoistways and elevator pits.

Such elevator machine rooms and hoistway/pit enclosures shall be constructed to afford at least the fireresistance rating specified in Table 601 and otherwise as required/allowed by the applicable portions of 780 CMR 7.00 (typically, but not always, the hoistway/pit and machine room will have a minimum fireresistance rating of two hours with elevator opening protectives rated at 1½ hours but ratings of 1 hour for hoistway/pit and machine rooms and ¾ hours for elevator opening protectives may be allowed). Where Table 602 requires a higher fireresistance rating for elevator machine rooms, hoistways and/or pits, such rating must be provided unless such ratings are governed by other sections of 780 CMR.

For elevator installation within atriums also see 780 CMR 404 for additional fireresistance rating guidance. Where the elevator machine room is determined to be a true penthouse roof structure, also refer to 780 CMR 1509.0 for additional fireresistance rating requirements.

5. Sprinklers shall not be required in noncombustible and limited combustible concealed spaces and plenums that contain electrical, data, communications and other cables that are of the types and in the configurations permitted in such spaces by 527 CMR 12.00: *Massachusetts Electrical Code*
6. Sprinklers may be omitted in Transformer Vaults where all the following conditions are satisfied:
   1. The cable within the vault is flame retardant or limited combustible.
   2. The dielectric fluid is a limited combustible fluid.
   3. The vault is enclosed in three hour fire resistance rated construction.
   4. The vault is at grade or no more than one level below grade. Access to the vault is directly from the exterior or via a dedicated two hour passageway.
   5. The vault is protected with automatic smoke detection connected to the building fire alarm system which notifies the fire department upon activation.
   6. The room is limited to the sole use of the transformer equipment and is limited in size to accommodate said equipment only. Storage is prohibited in the vault enclosure.
   7. The vault is provided with spill containment.

8. An emergency fire plan has been developed with and approved by the fire department.
9. Continuous ventilation is provided for the vault enclosure in accordance with the ventilation requirements of NFPA 30.
10. The ventilation equipment is dedicated to serve the vault only.
11. Emergency power is provided for the ventilation equipment.
12. The vault is no larger in area than 2400 sq. ft.

7. Sprinklers may be omitted in Transformer Vaults where all the following conditions are satisfied:

1. An alternative suppression system is provided for the vault.
2. Continuous ventilation is provided for the vault enclosure in accordance with the ventilation requirements of NFPA 30. Emergency power shall be provided for the ventilation equipment and the ventilation shall be dedicated to serve the vault only.

Note 1. Automatic sprinkler systems may be required by M.G.L. c. 148, § 26A, 26A½, 26G, 26G½, 26H or 26I.

903.2.1 Group A. An automatic sprinkler system shall be provided throughout buildings having a Group A occupancy as provided in 780 CMR 903.2.

903.2.1.1 Group A-1. An automatic sprinkler system shall be provided throughout buildings having a Group A-1 occupancy.

903.2.1.2 Group A-2. An automatic sprinkler system shall be provided throughout buildings as further described in 780 CMR 903.2.1.2.1 and 903.2.1.2.2.

903.2.1.2.1 Group A-2nc. An automatic sprinkler system shall be provided throughout buildings having a Group A-2nc occupancy where the occupant load is 50 or greater.

903.2.1.2.2 Group A-2r An automatic sprinkler system shall be provided throughout buildings having a Group A-2r occupancy where any of the following conditions exists:

1. The floor area exceeds 5,000 square feet (464.5 m^2).
2. The floor area has an occupant load of 300 or more.
3. The floor area is located on a floor other than the level of exit discharge.

903.2.1.3 Group A-3. An automatic sprinkler system shall be provided throughout buildings having a Group A-3 occupancy where any of the following conditions exists:

1. The aggregate floor area of the building exceeds 5,000 square feet (1115 m^2).
2. The Group A-3 occupancy has an occupant load of 300 or more.
3. The Group A-3 occupancy is located on a floor other than the level of exit discharge.

Exception. Areas used exclusively as participant sports areas where the main floor area is located at the same level as the level of exit discharge of the main entrance and exit.

903.2.1.4 Group A-4. An automatic sprinkler system shall be provided throughout buildings having a Group A-4 occupancy where any of the following conditions exists:

1. The aggregate floor area of the building exceeds 7,500 square feet (1115 m^2).
2. The Group A-4 occupancy has an occupant load of 300 or more.
3. The Group A-4 occupancy is located on a floor other than the level of exit discharge.

Exception. Areas used exclusively as participant sports areas where the main floor area is located at the same level as the level of exit discharge of the main entrance and exit.

903.2.1.5 Group A-5. An automatic sprinkler system shall be provided in concession stands, retail areas, press boxes and other accessory use areas in excess of 1,000 square feet (93 m^2).

903.2.2 Group B. An automatic sprinkler system shall be provided throughout buildings having a Group B occupancies where the aggregate floor area of the building exceeds 12,000 square feet (1115 m^2).

903.2.3 Group E. An automatic sprinkler system shall be provided for Group E occupancies as follows:

1. Where the aggregate floor area is greater than 12,000 square feet (1115 m^2) in area.
2. Throughout every portion of educational buildings below the level of exit discharge.

903.2.4 Group F-1. An automatic sprinkler system shall be provided throughout buildings having a Group F-1 occupancy where any of the following conditions exists:

1. The aggregate floor area of the building exceeds 12,000 square feet (1115 m^2);.
2. Group F-1 occupancy is located more than three stories above grade.
3. Where there is a woodworking operation in excess of 2,500 square feet (232 m^2) in area that generates finely divided combustible waste or uses finely divided combustible materials.

903.2.5 Group H. An automatic sprinkler system shall be provided throughout all buildings having a Group H occupancy.

Exception. See 780 CMR 903.3.1.1.1

903.2.5.1 Pyroxylin Plastics. An automatic sprinkler system shall be provided in buildings, or portions thereof, where cellulose nitrate film or pyroxylin plastics are manufactured, stored or handled in quantities exceeding 100 pounds (45 kg) (Also refer to 527 CMR).

903.2.6 Group I. An automatic sprinkler system shall be provided throughout buildings with a Group I occupancy.

Exception. An automatic sprinkler system installed in accordance with 780 CMR 903.3.1.1 or 903.3.1.2 shall be allowed in Group I-1 facilities.

903.2.7 Group M. An automatic sprinkler system shall be provided throughout buildings containing a Group M occupancy where any of the following conditions exists:

1. The aggregate floor area of the building exceeds 12,000 square feet (1115 m^2);.
2. The Group M occupancy is located more than three stories above grade;
3. Bulk merchandising stores as defined in 780 CMR 426.0.

903.2.8 Group R. An automatic sprinkler system installed in accordance with 780 CMR 903.3 shall be provided throughout all buildings with a Group R occupancy. For Use Group R Buildings with an aggregate building area of 12,000 sf or more, the sprinkler system shall be designed and installed in accordance with NFPA 13. For the purposes of 780 CMR 903.2, the aggregate building area shall be the combined area of all stories of the building and fire walls shall not be considered to create separate buildings.

Exceptions:

1. Buildings, other than R-1 Occupancies and R-2 Dormitories, having no more than three dwelling units shall be permitted to have an automatic fire suppression system installed in accordance with 780 CMR 903.3.1.3, provided that every automatic sprinkler system shall have at least one automatic water supply or a stored water supply source in accordance with NFPA-13D where the minimum quantity of stored water shall equal the water demand rate times 20 minutes.
2. For one- or two-family "stand-alone" dwellings classified as R-3 buildings, refer to 780 CMR 5313.5 – Note, however, that townhouses are required to be sprinklered.

903.2.9 Group S-1. An automatic sprinkler system shall be provided for Group S-1 occupancies as follows:

1. Throughout the building where the aggregate floor area of the building is greater than 12,000 square feet in area.
2. Throughout the building, where a Group S-1 occupancy is located more than three stories above grade.

903.2.9.1 Repair Garages. An automatic sprinkler system shall be provided throughout all buildings having a repair garages where any of the following conditions exists:

1. Where the building is two or more stories in height, including basements, and contains a repair garage exceeding 10,000 square feet (929 m^2).
2. The aggregate floor area of the building exceeds12,000 square feet (1115 m^2).
3. A repair garage is located in a basement.

903.2.10 Group S-2. An automatic sprinkler system shall be provided for Group S-2 occupancies as follows:

1. Throughout buildings classified as Group S-2 Enclosed Parking.
2. Throughout Group S-2 Enclosed Parking located beneath other groups.

903.2.10.1 Commercial Parking Garages. An automatic sprinkler system shall be provided throughout buildings used for storage of commercial trucks or buses where the aggregate floor area used for parking exceeds 5,000 square feet (464 m^2).

903.2.11 All Occupancies (Except Groups R-3 and U). An automatic sprinkler system shall be installed in the locations set forth in 780 CMR 903.2.11.1 through 903.2.11.1.3.

903.2.11.1 Stories and Basements without Openings. An automatic sprinkler system shall be installed throughout every story or basement of all buildings where the floor area exceeds 1,500 square feet (139.4 m^2) and where there is not provided at least one of the following types of exterior wall openings:

1. Openings below grade that lead directly to ground level by an exterior stairway complying with 780 CMR 1009 or an outside ramp complying with 780 CMR 1010. Openings shall be located in each 50 linear feet (15 240 mm), or fraction thereof, of exterior wall in the story on at least one side.
2. Openings entirely above the adjoining ground level totaling at least 20 square feet (1.86 m^2) in each 50 linear feet (15 240 mm), or fraction thereof, of exterior wall in the story on at least one side.

903.2.11.1.1 Opening Dimensions and Access. Openings shall have a minimum dimension of not less than 30 inches (762 mm). Such openings shall be accessible to the fire department from the exterior and shall not be obstructed in a manner that fire fighting or rescue cannot be accomplished from the exterior.

903.2.11.1.2 Openings on One Side Only. Where openings in a story are provided on only one side and the opposite wall of such story is more than 75 feet (22 860 mm) from such openings, the story shall be equipped throughout with an approved automatic sprinkler system, or openings as specified above shall be provided on at least two sides of the story.

903.2.11.1.3 Basements. Where any portion of a basement is located more than 75 feet (22 860 mm) from openings required by 780 CMR 903.2.10.1, the basement shall be equipped throughout with an approved automatic sprinkler system.

903.2.11.2 Rubbish and Linen Chutes. An automatic sprinkler system shall be installed at or above the topmost service opening of rubbish and linen chutes and in their terminal rooms. Chutes extending through three or more floors shall have additional sprinkler heads installed within such chutes at alternate floors. Chute sprinklers shall be accessible for servicing.

903.2.11.3 Buildings over 55 Feet in Height. An automatic sprinkler system shall be installed throughout buildings with a floor level having an occupant load of 30 or more that is located 55 feet (16 764 mm) or more above the lowest level of fire department vehicle access.

Exceptions:

1. Airport control towers.
2. Open parking structures.

903.2.12 Other Required Suppression Systems. In addition to the requirements of 780 CMR 903.2, the provisions indicated in Table 903.2.12 also require the installation of a suppression system for certain buildings and areas.

TABLE 903.2.12 ADDITIONAL REQUIRED OR POTENTIALLY REQUIRED SUPPRESSION/EXTINGUISHING SYSTEMS

SECTION	SUBJECT
Table 302.1.1	Incidental Use Areas
402.8	Covered malls
403.2	High-rise buildings
404.3	Atriums
405.3	Underground structures
407.5	Group I-2
410.6	Stages
411.4	Special amusement buildings
412.2.5, 412.2.6	Aircraft hangars
415.7.2.4	Group H-2*
416.4	Flammable finishes
417.4	Drying rooms
422.4.6, 422.5.2	Day care centers
422.5.3	Day care centers
424.5	Bulk Merchandising Retail Buildings
425.3.5	Limited Group Residence
426.9.1	Detoxification Facilities
427.2 as applicable	Group Dwelling Units
507	Unlimited area buildings
IMC	Commercial cooking operations
IMC	Ducts conveying hazardous exhausts
IFC-Section 903,	Numerous
IFC-Section 904	Numerous
M.G.L. c. 148, § 26A	High-rise
M.G.L. c. 148,§ 26A½	High-rise
M.G.L. c. 148,§ 26G	Buildings over 7,500 ft^2 (local option law)
M.G.L. c. 148,§ 26G½	Nightclubs
M.G.L. c. 148,§ 26H	Lodging Houses (local option law)
M.G.L. c. 148,§ 26I	four or more residential units (local option law)

*Review all H USES for possible sprinklering requirements.

903.3 Installation Requirements. Automatic sprinkler systems shall be designed and installed in accordance with 780 CMR 903.3.1 through 903.3.7.

903.3.1 Standards. Sprinkler systems shall be designed and installed in accordance with 780 CMR 903.3.1.1, 903.3.1.2 or 903.3.1.3.

903.3.1.1 NFPA 13 Sprinkler Systems. Where the provisions of 780 CMR require that a building or portion thereof be equipped throughout with an automatic sprinkler system in accordance with 780 CMR 903.3.1.1, sprinklers shall be installed throughout in accordance with NFPA 13 except as provided in 780 CMR 903.3.1.1.1.

903.3.1.1.1 Exempt Locations. Automatic sprinklers shall not be required in the rooms or areas noted in 780 CMR 903.2, *Exceptions*.

903.3.1.2 NFPA 13R Sprinkler Systems. Where allowed in buildings of Group R, up to and including four stories in height, automatic sprinkler systems shall be installed throughout in accordance with NFPA 13R.

903.3.1.2.1 Balconies. Sprinkler protection shall be provided for exterior balconies and ground-floor patios of dwelling units where the building is of Type V construction. Sidewall sprinklers that are used to protect such areas shall be permitted to be located such that their deflectors are within one inch (25 mm) to six inches (152 mm) below the structural members, and a maximum distance of 14 inches (356 mm) below the deck of the exterior balconies that are constructed of open wood joist construction.

903.3.1.3 NFPA 13D Sprinkler Systems. Where allowed, automatic sprinkler systems shall be installed throughout in accordance with NFPA 13D.

903.3.2 Fast Response Automatic Sprinklers. Where automatic sprinkler systems are required by 780 CMR, fast response automatic sprinklers shall be installed in the following areas in accordance with 780 CMR 903.3.1 and their listings:

1. Throughout all spaces within a smoke compartment containing patient sleeping units in Group I-2 in accordance with 780 CMR.
2. In Group R and I-1 occupancies.
3. Light-hazard occupancies as defined in NFPA 13.
4. Residential sprinklers shall be installed in areas where one or more rooms are arranged for the use of one or more individuals living together, as in a single housekeeping unit normally having cooking, living, sanitary or sleeping facilities including but not limited to: hotel rooms, dorm rooms, apartment units, condo units, and sleeping rooms in nursing homes and hospitals.

903.3.3 Obstructed Locations. Automatic sprinklers shall be installed with due regard to obstructions that will delay activation or obstruct the water distribution pattern. Automatic sprinklers shall be installed in or under covered kiosks, displays, booths, concession stands, or equipment that exceeds four feet (1219 mm) in width. Not less than a three-foot (914 mm) clearance shall be maintained between automatic sprinklers and the top of piles of combustible fibers.

Exception. Kitchen equipment under exhaust hoods protected with a fire-extinguishing system in accordance with 780 CMR 904.0.

903.3.4 Actuation. Automatic sprinkler systems shall be automatically actuated unless specifically provided for in 780 CMR.

903.3.5 Water Supplies. Water supplies for automatic sprinkler systems shall comply with 780 CMR 903.3.5 and the standards referenced in 780 CMR 903.3.1. The potable water supply shall be protected against backflow in accordance with 310 CMR 22.22.

903.3.5.1 Domestic Services. Where the domestic service provides the water supply for the automatic sprinkler system, the supply shall be in accordance with 780 CMR 903.3.5.1.

903.3.5.1.1 Limited Area Sprinkler Systems. Limited area sprinkler systems serving fewer than 20 sprinklers on any single connection are permitted to be connected to the domestic service where a wet automatic standpipe is not available. Limited area sprinkler systems connected to domestic water supplies shall comply with each of the following requirements:

1. Valves shall not be installed between the domestic water riser control valve and the sprinklers.

   Exception. An approved indicating control valve supervised in the open position in accordance with 780 CMR 903.4.

2. The domestic service shall be capable of supplying the simultaneous domestic demand and the sprinkler demand required to be hydraulically calculated by NFPA 13, NFPA 13R or NFPA 13D.

903.3.5.1.2 Combination Services. A single combination water supply shall be permitted provided that the domestic and/or commercial demand is added to the sprinkler demand as required by NFPA 13, NFPA 13D or NFPA 13R as applicable.

903.3.5.2 Secondary Water Supply. A secondary on-site water supply equal to the hydraulically calculated sprinkler demand, including the hose stream requirement, shall be provided for high-rise buildings in Seismic Design Category C, D, E or F as determined by 780 CMR. The secondary water supply shall have a duration not less than 30 minutes as determined by the occupancy hazard classification in accordance with NFPA 13.

Exception. Existing buildings.

903.3.6 Hose Threads. Fire hose threads used in connection with automatic sprinkler systems shall be approved and compatible with fire department hose threads.

903.3.7 Fire Department Connections. The location of fire department connections shall be approved by the head of the fire department. Fire department connections shall not be obstructed by fences, bushes, trees, walls, or any other similar object(s).

903.3.7.1 Locking Fire Department Connection (FDC) Caps. The head of the fire department is authorized to require locking FDC caps on fire department connections for water-based fire protection systems where the responding fire department carries appropriate key wrenches for removal.

903.3.7.2 Connections. Fire department connections shall be arranged in such a manner that the attachment to any one water sprinkler connection will serve all sprinklers.

903.4. Alarms. Approved audible and visual alarm devices shall be connected to every water sprinkler system. Such alarm devices shall be activated by water flow and shall be located in an approved location on the exterior of the building and throughout the building in accordance with the requirements of 780 CMR 907.

903.5 Floor Control Valves. Approved supervised indicating control valves shall be provided at the point of connection to the riser on each floor in high-rise buildings.

903.6 Inspection, Testing, and Maintenance. Sprinkler systems shall be inspected, tested and maintained in accordance with 527 CMR and NFPA 25.

780 CMR 904.0 ALTERNATIVE AUTOMATIC FIRE-EXTINGUISHING SYSTEMS

904.1 General. Automatic fire-extinguishing systems, other than automatic sprinkler systems, shall be designed, installed, inspected, tested and maintained in accordance with the provisions of 780 CMR 904.0 and the applicable referenced standards.

904.2 Where Required. Automatic fire-extinguishing systems installed as an alternative to the required automatic sprinkler systems of 780 CMR 903.0 shall be approved by the building official. Automatic fire-extinguishing systems shall not be considered alternatives for the purposes of exceptions or reductions permitted by other requirements of 780 CMR.

904.2.1 Hood System Suppression. Each required commercial kitchen exhaust hood and duct system required by the 527 CMR or the *International Mechanical Code* to have a Type I hood shall be protected with an approved automatic fire-extinguishing system installed in accordance with 780 CMR.

904.3 Installation. Automatic fire-extinguishing systems shall be installed in accordance with 780 CMR 904.3.

904.3.1 Electrical Wiring. Electrical wiring shall be in accordance with 527 CMR 12.00: *Massachusetts Electrical Code*.

904.3.2 Actuation. Automatic fire-extinguishing systems shall be automatically actuated and provided with a manual means of actuation in accordance with 780 CMR 904.11.1.

904.3.3 System Interlocking. Automatic equipment interlocks with fuel shutoffs, ventilation controls, door closers, window shutters, conveyor openings, smoke and heat vents and other features necessary for proper operation of the fire-extinguishing system shall be provided as required by the design and installation standard utilized for the hazard.

904.3.4 Alarms and Warning Signs. Where alarms are required to indicate the operation of automatic fire-extinguishing systems, distinctive audible and visible alarms and warning signs shall be provided to warn of pending agent discharge. Where exposure to automatic-extinguishing agents poses a hazard to persons and a delay is required to ensure the evacuation of occupants before agent discharge, a separate warning signal shall be provided to alert occupants once agent discharge has begun. Audible signals shall be in accordance with 780 CMR 907.9.2.

904.3.5 Monitoring. Where a building fire alarm system is installed, automatic fire-extinguishing systems shall be monitored by the building fire alarm system in accordance with *NFPA 72*.

904.4 Inspection and Testing. Automatic fire-extinguishing systems shall be inspected and tested in accordance with the provisions of 780 CMR 904.4 prior to acceptance.

904.4.1 Inspection. Prior to conducting final acceptance tests, the following items shall be inspected:

1. Hazard specification for consistency with design hazard.
2. Type, location and spacing of automatic- and manual-initiating devices.
3. Size, placement and position of nozzles or discharge orifices.
4. Location and identification of audible and visible alarm devices.
5. Identification of devices with proper designations.
6. Operating instructions.

904.4.2 Alarm Testing. Notification appliances, connections to fire alarm systems and connections to approved supervising stations shall be tested in accordance with 780 CMR 904.4and 780 CMR 907.0 to verify proper operation.

904.4.2.1 Audible and visible signals. The audibility and visibility of notification appliances signaling agent discharge or system operation, where required, shall be verified.

904.4.3 Monitor Testing. Connections to protected premises and supervising station fire alarm systems shall be tested to verify proper identification and retransmission of alarms from automatic fire-extinguishing systems.

904.5 Wet-chemical Systems. Wet-chemical extinguishing systems shall be installed, maintained, periodically inspected and tested in accordance with *NFPA 17A* and their listing.

904.5.1 Discharge Test. All systems shall be tested by a discharge of expellant gas through the piping and nozzles with observations being made of the flow of expellant gas through all nozzles as well as observing for leakage and continuity of piping with free unobstructed flow.

904.6 Dry-chemical Systems. Dry-chemical extinguishing systems shall be installed, maintained, periodically inspected and tested in accordance with *NFPA 17* and their listing.

904.6.1 Discharge Test. All systems shall be tested by a discharge of expellant gas through the piping and nozzles with observations being made of the flow of expellant gas through all nozzles as well as observing for leakage and continuity of piping with free unobstructed flow.

904.7 Foam Systems. Foam-extinguishing systems shall be installed, maintained, periodically inspected and tested in accordance with *NFPA 11* and *NFPA 16* and their listing.

904.8 Carbon Dioxide Systems. Carbon dioxide extinguishing systems shall be installed, maintained, periodically inspected and tested in accordance with *NFPA 12* and their listing.

904.9 Halon Systems. Halogenated extinguishing systems shall be installed, maintained, periodically inspected and tested in accordance with *NFPA 12A* and their listing.

904.10 Clean-agent Systems. Clean-agent fire-extinguishing systems shall be installed, maintained, periodically inspected and tested in accordance with *NFPA 2001* and their listing.

904.11 Commercial Cooking Systems. The automatic fire-extinguishing system for commercial cooking systems shall be of a type recognized for protection of commercial cooking equipment and exhaust systems of the type and arrangement protected. Preengineered automatic dry- and wet-chemical extinguishing systems shall be tested in accordance with *UL 300* and listed and labeled for the intended application. Other types of automatic fire-extinguishing systems shall be listed and labeled for specific use as protection for commercial cooking operations. The system shall be installed in accordance with 780 CMR, its listing and the manufacturer's installation instructions. Automatic fire-extinguishing systems of the following types shall be installed in accordance with the referenced standard indicated, as shown:

1. Carbon dioxide extinguishing systems, *NFPA 12*.
2. Automatic sprinkler systems, *NFPA 13.*
3. Foam-water sprinkler system or foam-water spray systems, *NFPA 16.*
4. Dry-chemical extinguishing systems, *NFPA 17.*
5. Wet-chemical extinguishing systems, *NFPA 17A*.

> **Exception**. Factory-built commercial cooking recirculating systems that are tested in accordance with *UL 197*, and listed, labeled and installed in accordance with section 304.1 of the International Mechanical Code.

904.11.1 Manual System Operation. A manual actuation device shall be located at or near a means of egress from the cooking area, a minimum of ten feet (3048 mm) and a maximum of 20 feet (6096 mm) from the kitchen exhaust system. The manual actuation device shall be located a minimum of four feet (1219 mm) and a maximum of five feet (1524 mm) above the floor. The manual actuation shall require a maximum force of 40 pounds (178 N) and a maximum movement of 14 inches (356 mm) to actuate the fire suppression system.

> **Exception**. Automatic sprinkler systems shall not be required to be equipped with manual actuation means.

904.11.2 System Interconnection. The actuation of the fire suppression system shall automatically shut down the fuel or electrical power supply to the cooking equipment. The fuel and electrical supply reset shall be manual.

904.11.3 Carbon Dioxide Systems. When carbon dioxide systems are used, there shall be a nozzle at the top of the ventilating duct. Additional nozzles that are symmetrically arranged to give uniform distribution shall be installed within vertical ducts exceeding 20 feet (6096 mm) and horizontal ducts exceeding 50 feet (15 240 mm). Dampers shall be installed at either the top or the bottom of the duct and shall be arranged to operate automatically upon activation of the fire-extinguishing system. Where the damper is installed at the top of the duct, the top nozzle shall be immediately below the damper. Automatic carbon dioxide fire-extinguishing systems shall be sufficiently sized to protect against all hazards venting through a common duct simultaneously.

904.11.3.1 Ventilation System. Commercial-type cooking equipment protected by an automatic carbon dioxide-extinguishing system shall be arranged to shut off the ventilation system upon activation.

904.11.4 Special Provisions for Automatic Sprinkler Systems. Automatic sprinkler systems protecting commercial-type cooking equipment shall be supplied from a separate, readily accessible, indicating-type control valve that is identified.

904.11.4.1 Listed Sprinklers. Sprinklers used for the protection of fryers shall be listed for that application and installed in accordance with their listing.

904.12 Water Spray Fixed System. Water spray fixed systems shall be installed, maintained, periodically inspected and tested in accordance with *NFPA 15* and their listing.

780 CMR 905.0 STANDPIPE SYSTEMS

905.1 General. Standpipe systems shall be provided in new buildings and structures in accordance with 780 CMR 905.0. Fire hose threads used in connection with standpipe systems shall be compatible with connections used by the local fire department. The location of fire department hose connections shall be approved by the head of the fire department.

905.2 Installation standards. Standpipe systems shall be installed in accordance with 780 CMR 905.0 and *NFPA 14*. Where *standpipe systems* are required by 780 CMR, such systems shall be automatic wet systems.

Exceptions:

1. When approved by the head of the fire

department, an automatic dry or semi-automatic dry *standpipe systems* shall be permitted in areas subject to freezing.

2. A manual wet standpipe is permitted in buildings less than 70 feet in height which are equipped throughout with an approved automatic fire suppression system. However, the system may be designed to obtain the outlet pressures and water flows in accordance with NFPA 14 with inlet pressures at the fire department connection that are consistent with local fire department equipment."

905.3 Required Installations. Standpipe systems shall be installed where required by 780 CMR 905.3.1 through 905.3.6 and in the locations indicated in 780 CMR 905.4, 905.5 and 905.6. Standpipe systems are permitted to be combined with automatic sprinkler systems.

Exception. Standpipe systems are not required in Group R-3 occupancies as applicable in 780 CMR 101.2.

905.3.1 Building Height. Class III automatic standpipe systems shall be installed throughout buildings where the floor level of the highest story is located more than 30 feet (9144 mm) above the lowest level of fire department vehicle access, or where the floor level of the lowest story is located more than 30 feet (9144 mm) below the highest level of fire department vehicle access.

Exceptions:

1. Class I manual standpipes are allowed in open parking garages where the highest floor is located not more than 150 feet (45 720 mm) above the lowest level of fire department vehicle access.
2. Class I manual dry standpipes are allowed in open parking garages that are subject to freezing temperatures, provided that the hose connections are located as required for Class II standpipes in accordance with 780 CMR 905.5.

905.3.2 Group A. Class I automatic wet standpipes shall be provided in nonsprinklered Group A buildings having an occupant load exceeding 1,000 persons.

Exceptions:

1. Open-air-seating spaces without enclosed spaces.
2. Class I automatic dry and semiautomatic dry standpipes or manual wet standpipes are allowed in buildings where the highest floor surface used for human occupancy is 75 feet (22 860 mm) or less above the lowest level of fire department vehicle access.

905.3.3 Covered Mall Buildings. Hose connections shall be provided at each of the following locations:

1. Within the mall at the entrance to each exit passageway or corridor.
2. At each floor-level landing within enclosed stairways opening directly on the mall.
3. At exterior public entrances to the mall.

905.3.4 Stages. Stages greater than 1,000 square feet in area (93 m^2) shall be equipped with a Class III automatic wet standpipe system with 1½-inch and 2½-inch (38 mm and 64 mm) hose connections on each side of the stage. Where permitted by the head of the fire department, a Class I Standpipe may be installed.

Exception. Where the building or area is equipped throughout with an automatic sprinkler system, the hose connections are allowed to be supplied from the automatic sprinkler system and shall have a flow rate of not less than that required by *NFPA 14* for Class III standpipes.

905.3.4.1 Hose and Cabinet. The 1½-inch (38 mm) hose connections shall be equipped with sufficient lengths of 1½-inch (38 mm) hose to provide fire protection for the stage area. Hose connections shall be equipped with an approved adjustable fog nozzle and be mounted in a cabinet or on a rack.

905.3.5 Underground Buildings. Underground buildings shall be equipped throughout with a Class I automatic wet or manual wet standpipe system.

905.3.6 Helistops and Heliports. Buildings with a helistop or heliport that are equipped with a standpipe shall extend the standpipe to the roof level on which the helistop or heliport is located such that all areas of the helistop or heliport are within 150 feet of a Class I standpipe outlet.

905.3.7 High-piled Combustible Storage. A class I automatic wet or manual standpipe system shall be provided in all exit passageways of areas containing high-piled combustible storage.

905.3.8 Building Area. A class I automatic wet or manual standpipe system shall be provided in all buildings where any portion of the building floor area is more than 400 feet of travel from the nearest point of fire department vehicle access – note that in this instance, vehicle access travel distance is actual distance measured along and/or around the building exterior and shall not be argued reduced by the addition of fire walls/party walls which otherwise would define individual buildings.

905.3.9 Groups A-1 and A-2. In Group A-1 and A-2 occupancies with occupant loads of more than 1,000, shall be equipped with a Class II standpipe system.

905.4 Location of Class I Standpipe Hose Connections. Class I standpipe hose connections shall be provided in all of the following locations:

1. In every required stairway, a hose connection shall be provided for each floor level above or below grade. Unless otherwise required by the head of the fire department, hose connections shall be located at an intermediate floor level landing between floors.
2. On each side of the wall adjacent to the exit opening of a horizontal exit.
3. In every exit passageway at the entrance from the exit passageway to other areas of a building.
4. In covered mall buildings, adjacent to each exterior public entrance to the mall and adjacent to each entrance from an exit passageway or exit corridor to the mall.
5. Where the roof has a slope less than four units vertical in 12 units horizontal (33.3% slope), each standpipe shall be provided with a hose connection located either on the roof or at the highest landing of stairways with stair access to the roof. An additional hose connection shall be provided at the top of the most hydraulically remote standpipe for testing purposes.
6. The most remote portion of a nonsprinklered floor or story shall not be more than 150 feet (45 720 mm) from a hose connection or the most remote portion of a sprinklered floor or story is more than 200 feet (60 960 mm) from a hose connection, the head of the fire department is authorized to require that additional hose connections be provided in approved locations. *Where connections are provided outside of exit stairways, the locations shall be approved by the head of the fire department.*

905.4.1 Protection. Risers and laterals of Class I standpipe systems not located within an enclosed stairway or pressurized enclosure shall be protected by a degree of fire resistance equal to that required for vertical enclosures in the building in which they are located.

Exception. In buildings equipped throughout with an approved automatic sprinkler system, laterals that are not located within an enclosed stairway or pressurized enclosure are not required to be enclosed within fire-resistance-rated construction.

905.4.2 Interconnection. In buildings where more than one standpipe is provided, the standpipes shall be interconnected in accordance with *NFPA 14*.

905.4.3 1.5 inch Reducer. A removable 1.5 inch reducer and cap shall be provided on all Class I outlets.

905.5 Location of Class II Standpipe Hose Connections. Class II standpipe hose connections shall be accessible and located so that all portions of the building are within 30 feet (9144 mm) of a nozzle attached to 100 feet (30 480 mm) of hose.

905.5.1 Groups A-1 and A-2. In Group A-1 and A-2 occupancies with occupant loads of more than 1,000, hose connections shall be located on each side of any stage, on each side of the rear of the auditorium, on each side of the balcony and on each tier of dressing rooms.

905.5.2 Protection. Fire-resistance-rated protection of risers and laterals of Class II standpipe systems is not required.

905.5.3 Class II System 1-inch Hose. A minimum 1-inch (25 mm) hose shall be permitted to be used for hose stations in light-hazard occupancies where investigated and listed for this service and where approved by the building official.

905.6 Location of Class III Standpipe Hose Connections. Class III standpipe systems shall have hose connections located as required for Class I standpipes in 780 CMR 905.4 and shall have Class II hose connections as required in 780 CMR 905.5.

905.6.1 Protection. Risers and laterals of Class III standpipe systems shall be protected as required for Class I systems in accordance with 780 CMR 905.4.1.

905.6.2 Interconnection. In buildings where more than one Class III standpipe is provided, the standpipes shall be interconnected at the bottom.

905.7 Standpipe System Piping Sizes. The riser piping, supply piping, and the water service piping shall be hydraulically sized in accordance with the provisions of NFPA-14 listed in ***780 CMR 35.00***.

Exception. The residual pressure(s) as noted in NFPA-14 are not required to be maintained in buildings less than 70 feet in height which are equipped throughout with an approved automatic fire suppression system. However the system shall be designed to accommodate the outlet pressures and water flows in accordance with NFPA 14 and inlet pressures consistent with local fire department equipment..

905.8 High-rise Buildings. All buildings more than 70 feet in height above the mean grade shall have each floor supplied by a minimum of two combination standpipe/sprinkler risers installed in accordance with the requirements of NFPA-14, listed in ***780 CMR 35.00***.

905.9 Cabinets. Cabinets containing fire-fighting equipment such as standpipes, fire hoses, fire extinguishers or fire department valves shall not be blocked from use or obscured from view.

905.9.1 Cabinet Equipment Identification. Cabinets shall be identified in an approved manner by a permanently attached sign with letters not less than two inches (51 mm) high in a color that contrasts with the background color, indicating the equipment contained therein.

Exceptions:

1. Doors not large enough to accommodate a written sign shall be marked with a permanently attached pictogram of the equipment contained therein.
2. Doors that have either an approved visual identification clear glass panel or a complete glass door panel are not required to be marked.

905.9.2 Locking cabinet doors. Cabinets shall be unlocked.

Exceptions:

1. Visual identification panels of glass or other approved transparent frangible material that is easily broken and allows access.
2. Approved locking arrangements.
3. Group I-3.

905.10 Valve Supervision. Valves controlling water supplies shall be supervised in the open position so that a change in the normal position of the valve will generate a supervisory signal at the supervising station required by 780 CMR 903.4. Where a fire alarm system is provided, a signal shall also be transmitted to the control unit.

Exceptions:

1. Valves to underground key or hub valves in roadway boxes provided by the municipality or public utility do not require supervision.
2. Valves locked in the normal position and inspected as provided in 780 CMR in buildings not equipped with a fire alarm system.

905.11 During Construction. Standpipe systems required during construction and demolition operations shall be provided in accordance with 780 CMR 3311.0 and NFPA 241.

780 CMR 906.0 PORTABLE FIRE EXTINGUISHERS

906.1 General. Portable fire extinguishers shall be provided in occupancies and locations as required by 527 CMR and 906.2.

906.2 Where Required. A portable fire extinguisher shall be installed in the following locations in accordance with NFPA 10 listed in *780 CMR 35.00*:

1. In all occupancies in Use Group A-1, A-2, A-3, B, E, I-2, M, R-1 or H;
2. In all areas containing commercial kitchen exhaust hood systems;
3. In all areas where fuel is dispensed;
4. In all areas where a *flammable* or *combustible liquid* is used in the operation of spraying, coating or dipping;
5. In all occupancies in Use Group I-3 at staff locations. Access to portable extinguishers shall be permitted to be locked;
6. On each completed floor of buildings under construction, other than occupancies in Use Group R-3.
7. In any laboratory, shop or other room occupied for similar purposes; and

906.3 Approval. Portable fire extinguishers shall bear the label of an *approved agency*, be of an approved type and be installed in a location visible and available to the occupants.

780 CMR 907.0 FIRE ALARM AND DETECTION SYSTEMS

907.1 General. 780 CMR 907.0 covers the application, installation, performance and maintenance of fire alarm systems and their components.

907.1.1 Construction Documents.

907.1.1.1 Construction documents required to accompany an application for a building permit shall include, but not be limited to, all of the following:

1. Narrative report
    a. Basis (methodology) of design for the protection of the occupancy and hazards for compliance with 780 CMR and applicable NFPA standards, in the form of a narrative report.
    b. Sequence of operation of all fire protection systems and operation in the form of a narrative report.
    c. Testing criteria to be used for final system acceptance in the form of a narrative report.
2. ***Dedicated plans that*** indicate the use of all rooms and document the location of all fire alarm equipment and devices in accordance with NFPA 72. The sequences of operation shall appear on the fire alarm plans as well as the narrative report.
3. Fire alarm equipment and device symbol legend.
4. ***Primary Power Connection***.
5. Details of ceiling height and construction.
6. The interface of fire safety control functions
7. The location of any equipment or devices that directly interface with the fire alarm system.
8. Fire alarm system riser diagram.

907.1.1.2 Construction Documents Required Prior to the Installation of Fire Alarm Equipment or Devices. In addition to the documents shall be included but not be limited to:

1. Manufacturers, models numbers and listing information for equipment, devices and materials.
2. Circuitry layout, conductor types and sizes.
3. Voltage drop calculations
4. Battery calculations

5. Any amendments to the documents provided under 780 CMR 907.1.1.1.

907.1.1.3 Construction documents required prior to acceptance testing of fire alarm equipment or devices shall include but not be limited to:

1. as built plans
2. Input/output matrix
3. Any amendments to the documents provided under 780 CMR 907.1.1.1 and 907.1.1.2

907.1.2 Equipment. Systems and their components shall be listed or approved by a nationally recognized testing laboratory for the purpose for which they are installed.

907.2 Where Required. Manual, automatic or manual and automatic fire alarm system shall be provided in accordance with 780 CMR 907.2.1 through 907.2.23. Where automatic sprinkler protection, installed in accordance with 780 CMR 903.3.1.1 or 903.3.1.2, is provided and connected to the building fire alarm system, automatic heat detection required by 780 CMR 907.2 shall not be required. An automatic fire detection system shall be installed in accordance with the provisions of 780 CMR and *NFPA 72*. Devices, combinations of devices, appliances and equipment shall comply with 780 CMR 907.1.2. The automatic fire detectors shall be smoke detectors, except that an alternative type of detector shall be installed in spaces such as boiler rooms where, during normal operation, products of combustion are present in sufficient quantity to actuate a smoke detector.

907.2.1 Group A. A manual fire alarm system, consisting of a fire alarm control panel, manual fire alarm boxes (pull stations) and audible and visual alarm notification appliances shall be installed in accordance with *NFPA 72* in Group A occupancies having an occupant load of 50 or more. Portions of Group E occupancies occupied for assembly purposes shall be provided with a fire alarm system as required for the Group E occupancy.

907.2.1.1 System Initiation in Group a Occupancies with an Occupant Load of 300 or More. Activation of the fire alarm in Group A occupancies with an occupant load of 1,000 or more shall initiate a signal using an emergency voice/alarm communications system in accordance with *NFPA 72*.

Where the head of the fire department or his /her designee determines that partial or selective evacuation is not desired, but rather total evacuation is required, then a distinctive signal in lieu of a voice alarm is permitted.

907.2.2 Group B. A manual fire alarm system shall be installed in Group B occupancies having an occupant load of 500 or more persons or more than 100 persons above or below the lowest level of exit discharge.

907.2.3 Group E. A manual and automatic fire alarm system with emergency voice/alarm capabilities in accordance with 907.2.12.2 shall be installed in Group E occupancies. When automatic sprinkler systems or smoke detectors are installed, such systems or detectors shall be connected to the building fire alarm system.

Exceptions:

1. Group E occupancies with an occupant load of less than 50.
2. Buildings equipped throughout with an automatic sprinkler system are not required to be equipped with an automatic fire detection system.

907.2.3.1 Where an automatic system is required the automatic detectors shall be smoke detectors. Coverage shall be in accordance with NFPA 72.

907.2.4 Group F. A manual fire alarm system shall be installed in Group F occupancies that are two or more stories in height and have an occupant load of 500 or more above or below the lowest level of exit discharge.

907.2.5 Group H. A manual fire alarm system shall be installed in Group H5 occupancies and in occupancies used for the manufacture of organic coatings. An automatic smoke detection system shall be installed for highly toxic gases, organic peroxides and oxidizers.

907.2.6 Group I. A manual fire alarm system and an automatic fire detection system shall be installed in Group I occupancies. An automatic smoke detection system shall be provided in waiting areas that are open to corridors.

Exception. Manual fire alarm boxes in patient sleeping areas of Group I-1 and I-2 occupancies shall not be required at exits if located at all nurses' control stations or other constantly attended staff locations, provided such stations are visible and continuously accessible and that travel distances required in 780 CMR 907.3.1 are not exceeded.

907.2.6.1 Group I-2. Corridors in nursing homes (both intermediate-care and skilled nursing facilities), detoxification facilities and spaces open to the corridors shall be equipped with an automatic fire detection system.

Exceptions:

1. Corridor smoke detection is not required in smoke compartments that contain patient sleeping rooms where patient sleeping units are provided with smoke detectors that comply with UL 268. Such detectors shall provide a visual display on the corridor side of each patient sleeping unit and an audible and visual alarm at the nursing station attending each unit.

2. Corridor smoke detection is not required in smoke compartments that contain patient sleeping rooms where patient sleeping unit doors are equipped with automatic door-closing devices with integral smoke detectors on the unit sides installed in accordance with their listing, provided that the integral detectors perform the required alerting function.

907.2.6.2 Group I-3. Group I-3 occupancies shall be equipped with a manual and automatic fire alarm system installed for alerting staff.

907.2.6.2.1 System Initiation. Actuation of an automatic fire-extinguishing system, a manual fire alarm box or a fire detector shall initiate an approved fire alarm signal which automatically notifies staff. Presignal systems shall not be used.

907.2.6.2.2 Manual Fire Alarm Boxes. Manual fire alarm boxes are not required to be located in accordance with 780 CMR 907.3 where the fire alarm boxes are provided at staff-attended locations having direct supervision over areas where manual fire alarm boxes have been omitted. Manual fire alarm boxes shall be permitted to be locked in areas occupied by detainees, provided that staff members are present within the subject area and have keys readily available to operate the manual fire alarm boxes.

907.2.6.2.3 Smoke Detectors. An approved automatic smoke detection system shall be installed throughout resident housing areas, including sleeping areas and contiguous day rooms, group activity spaces and other common spaces normally accessible to residents.

Exception. Other approved smoke detection arrangements providing equivalent protection including, but not limited to, placing detectors in exhaust ducts from cells or behind protective guards listed for the purpose are allowed when necessary to prevent damage or tampering.

907.2.7 Group M. A manual fire alarm system shall be installed in Group M occupancies having an occupant load of 500 or more persons or more than 100 persons above or below the lowest level of exit discharge.

Exception. Manual fire alarm boxes are not required if the building is equipped throughout with an automatic sprinkler system and the alarm notification appliances will activate upon sprinkler water flow.

907.2.7.1 Occupant Notification. During times that the building is occupied, in lieu of the automatic activation of alarm notification appliances, the manual fire alarm system shall be allowed to activate an alarm signal at a constantly attended location from which evacuation instructions shall be initiated over an emergency voice/alarm communication system installed in accordance with 780 CMR 907.2.12.2. The emergency voice/alarm communication system shall be allowed to be used for other announcements, provided the manual fire alarm use takes precedence over any other use.

907.2.8 Group R-1. Fire alarm systems shall be installed in Group R-1 occupancies as required in 780 CMR 907.2.8.1 through 907.2.8.3 and in accordance with Table 907.2.8.

TABLE 907.2.8 - RESIDENTIAL FIRE PROTECTION REQUIREMENTS

Use Group	Number of Units	Unit Occupant Protection	Other Occupant Protection	Standby Power	Manual Stations	Zoned	Provision for Fire Department Notification
R-3	1 or 2	Yes	Note a.	Yes	N.A.	N.A.	N.A.
R-1	3 to 12	Yes	Yes	Yes	Yes	N.A.	N.A.
R-2	3 to 12	Yes	Yes	Yes	Yes	N.A.	N. A.
R-1	13 or more	Yes	Yes	Yes	Yes	Yes	Yes
R-2	13 or more	Yes	Yes	Yes	Yes	Yes	Yes

Note a: Where common areas exist.

907.2.8.1 Manual Fire Alarm System. A manual fire alarm system shall be installed in Group R-1 occupancies.

Exception. A manual fire alarm system is not required in buildings not over two stories in height where all individual guestrooms and contiguous attic and crawl spaces are separated from each other and public or common areas by at least one-hour fire partitions and each individual guestroom has an exit directly to a public way, exit court or yard.

907.2.8.2 Automatic Fire Alarm System. An automatic fire alarm system shall be installed throughout all interior corridors serving guestrooms.

Exception. An automatic fire detection system is not required in buildings that do not have interior corridors serving guestrooms and each guestroom has a means of egress door opening directly to an exterior exit access that leads directly to an exit.

907.2.8.3 Smoke Alarms. Smoke alarms shall be installed as required by 780 CMR 907.2.10. In buildings that are not equipped throughout with an automatic sprinkler system installed in accordance with 780 CMR 903.3.1.1 or 903.3.1.2, the smoke alarms in guestrooms shall be connected to an emergency electrical system and shall be annunciated by guestroom at a constantly attended location from which the fire alarm system is capable of being manually activated.

780 CMR 907.2.8 shall not preclude the installation of a fully addressable fire alarm system where system detectors and alarm notifications devices can perform the functions as required in 780 CMR 907.2.10.

907.2.9 Group R-2. A manual fire alarm system and an automatic fire detection system shall be installed in Group R-2 occupancies and in accordance with Table 907.2.8.

Exception. A manual fire alarm system is not required in buildings with 12 or less dwelling units.

907.2.10 Single- and Multiple-station Smoke Alarms. Listed single- and multiple-station photoelectric type smoke alarms shall be installed in accordance with the provisions of 780 CMR and the household fire-warning equipment provisions of *NFPA 72*.

907.2.10.1 Where Required. Single- or multiple-station smoke alarms shall be installed in the locations described in 780 CMR 907.2.10.1.1 through 907.2.10.1.4.

907.2.10.1.1 Group R-1. Single- or multiple-station smoke alarms shall be installed in all of the following locations in Group R-1:

1. In sleeping areas.
2. In every room in the path of the means of egress from the sleeping area to the door leading from the sleeping unit.
3. In each story within the sleeping unit, including basements. For sleeping units with split levels and without an intervening door between the adjacent levels, a smoke alarm installed on the upper level shall suffice for the adjacent lower level provided that the lower level is less than one full story below the upper level.

907.2.10.1.2 Groups R-2, R-3, R-4 and I-1. Single- or multiple-station smoke alarms shall be installed and maintained in Groups R-2, R-3, R-4 and I-1, regardless of occupant load at all of the following locations:

1. On the ceiling or wall outside of each separate sleeping area in the immediate vicinity of bedrooms.
2. In each room used for sleeping purposes.
3. each story within a dwelling unit, including basements but not including crawl spaces and uninhabitable attics. In dwellings or dwelling units with split levels and without an intervening door between the adjacent levels, a smoke alarm installed on the upper level shall suffice for the adjacent lower level provided that the lower level is less than one full story below the upper level.

907.2.10.1.3 Group I-1. Single- or multiple-station smoke alarms shall be installed and maintained in sleeping areas in occupancies in Group I-1. Single- or multiple-station smoke alarms shall not be required where the building is equipped throughout with an automatic fire detection system in accordance with 780 CMR 907.2.6.

907.2.10.1.4 Other Sleeping Areas. *Any area intended or used for sleeping purposes and occupants are capable of self-preservation."*

907.2.10.2 Power Source. In new construction, required smoke alarms shall receive their primary power from the building wiring where such wiring is served from a commercial source and shall be equipped with a battery backup. Smoke alarms shall emit a signal when the batteries are low. Wiring shall be permanent and without a disconnecting switch other than as required for overcurrent protection.

Exception. Smoke alarms are not required to be equipped with battery backup in Group R-1 where they are connected to an emergency electrical system.

907.2.10.3 Interconnection. Where more than one smoke alarm is required to be installed within an individual dwelling unit in Group R-2, R-3 or R-4, or within an individual dwelling unit or sleeping unit in Group R-1, the smoke alarms shall be interconnected in such a manner that the activation of one alarm will activate all of the alarms in the individual unit. The alarm shall be clearly audible in all bedrooms over background noise levels with all intervening doors closed.

907.2.10.4 Acceptance Testing. When the installation of the alarm devices is complete, each detector and interconnecting wiring for multiple-station alarm devices shall be tested in accordance with the household fire warning equipment provisions of *NFPA 72*.

907.2.11 Special Amusement Buildings. An approved automatic smoke detection system shall be provided in special amusement buildings in accordance with 780 CMR 907.2.

Exception. In areas where ambient conditions will cause a smoke detection system to alarm, an approved alternative type of automatic detector shall be installed.

907.2.11.1 Alarm. Activation of any single smoke detector, the automatic sprinkler system or any other automatic fire detection device shall immediately sound an alarm at the building at a constantly attended location from which emergency action can be initiated, including the capability of manual initiation of requirements in 780 CMR 907.2.11.2.

907.2.11.2 System Response. The activation of two or more smoke detectors, a single smoke detector with alarm verification, the automatic sprinkler system or other approved fire detection device shall automatically:

1. Cause illumination of the means of egress with light of not less than 1 foot-candle (11 lux) at the walking surface level;
2. Stop any conflicting or confusing sounds and visual distractions; and
3. Activate an approved directional exit marking that will become apparent in an emergency. Such system response shall also include activation of a prerecorded message, clearly audible throughout the special amusement building, instructing patrons to proceed to the nearest exit. Alarm signals used in conjunction with the prerecorded message shall produce a sound which is distinctive from other sounds used during normal operation. The wiring to the auxiliary devices and equipment used to accomplish the above fire safety functions shall be monitored for integrity in accordance with *NFPA 72*.

907.2.11.3 Emergency Voice/Alarm Communication System. An emergency voice/alarm communication system, which is also allowed to serve as a public address system, shall be installed in accordance with *NFPA 72*, and shall be audible throughout the entire special amusement building.

907.2.12 High-rise Buildings. Buildings having floors used for human occupancy located more than 70 feet above grade plane shall be provided with an automatic fire alarm system and an emergency voice/alarm communication system in accordance with 780 CMR 907.2.12.2. Note. Also see 780 CMR 403.0.

Exceptions:

1. Airport traffic control towers in accordance with 780 CMR 412.0 and 907.2.22.
2 Open parking garages in accordance with 780 CMR 406.3.
3. Buildings with an occupancy in Group A-5.
4. Low-hazard special occupancies in accordance with 780 CMR 503.1.2.
5. Buildings with an occupancy in Group H-1, H-2 or H-3 in accordance with 780 CMR 415.

907.2.12.1 Automatic Fire Detection. Smoke detectors shall be provided in accordance with780 CMR 907.2.12. Smoke detectors shall be connected to an automatic fire alarm system. The activation of any detector required by 780 CMR 907.2.12 shall operate the emergency voice/alarm communication system. Smoke detectors shall be located as follows:

1. In each mechanical equipment, electrical, transformer, telephone equipment or similar room which is not provided with sprinkler protection, elevator machine rooms and in elevator lobbies.
2. In the main return air and exhaust air plenum of each air-conditioning system having a capacity greater than 2,000 cubic feet per minute (cfm) (0.94 m^3/s). Such detectors shall be located in a serviceable area downstream of the last duct inlet.
3. At each connection to a vertical duct or riser serving two or more stories from a return air duct or plenum of an air-conditioning system. In Group R-1 and R-2 occupancies a listed smoke detector is allowed to be used in each return air riser carrying not more than 5,000 cfm (2.4 m^3/s) and serving not more than 10 air inlet openings.

907.2.12.2 Emergency Voice/Alarm Communication System. The operation of any automatic fire detector, sprinkler water-flow device or manual fire alarm box shall automatically sound an alert tone followed by voice instructions giving approved information and directions on a general or selective basis to the following terminal areas on a minimum of the alarming floor, the floor above and the floor below:

1. Elevator lobbies.
2. Corridors.
3. Rooms and tenant spaces exceeding 1,000 square feet (93 m^2) in area.
4. Dwelling units or sleeping units in Group R-2 occupancies.
5. Sleeping units in Group R-1 occupancies.
6. Areas of refuge as defined in 780 CMR 1002.0.
7. All habitable areas of use group E.

Exception. In Group I-1 and I-2 occupancies, the alarm shall sound in a constantly attended area and a general occupant notification shall be broadcast over the overhead page.

907.2.12.2.1 Manual Override. A manual override for emergency voice communication shall be provided for all paging zones.

907.2.12.2.2 Live Voice Messages. The emergency voice/alarm communication system shall also have the capability to broadcast live voice messages through speakers located in elevators, exit stairways and throughout a selected floor or floors.

907.2.12.2.3 Standard. The emergency voice/alarm communication system shall be designed and installed in accordance with *NFPA 72*.

907.2.12.2.4 The sequence of operation of the voice alarm signaling system shall be as follows:

1. sound an alert (pre-signal) tone (the alert tone shall be a 900 hertz tone pulsed to produce one round of code 4 at approximately one second intervals.
2. Activate the recorded message regarding the evacuation procedure. The alarm and communications system shall provide a pre-recorded message to all required areas. The message shall contain the following information. *"attention please. The signal tone you have just heard indicated a report of an emergency in this building. If your floor evacuation signal sounds after this message, walk to the nearest stairway and leave the floor. While the report is being verified, occupants on other floors should await further instructions."*

   This message shall be transmitted Three times.

   A female voice shall be used for this message.
3. Activate the evacuation signal on the floor of incident and the next floor above and below

Exception. Alternatives to the requirements of 780 CMR 907.2.12 when part of an approved fire safety and evacuation plan in accordance with 527 CMR 10.13

907.2.12.3 Fire Department Communication System. An approved two-way, fire department communication system designed and installed in accordance with *NFPA 72* shall be provided for fire department use. It shall operate between a fire command center complying with 780 CMR 911.0 and elevators, elevator lobbies, emergency and standby power rooms, fire pump rooms, areas of refuge and inside enclosed exit stairways. The fire department communication device shall be provided at each floor level within the enclosed stairway.

Exception. Fire department radio systems where approved by the fire department.

907.2.13 Atriums Connecting More than Two Stories. A fire alarm system shall be installed in occupancies with an atrium that connects more than two stories. The system shall be activated in accordance with 780 CMR 907.7. Such occupancies in Group A, E or M shall be provided with an emergency voice/alarm communication system complying with the requirements of 780 CMR 907.2.12.2.

907.2.14 High-piled Combustible Storage Areas. An automatic fire detection system shall be installed throughout high-piled combustible storage areas greater than 500 square feet.

Exception. Buildings protected throughout with automatic sprinklers.

907.2.15 Delayed Egress Locks. Where delayed egress locks are installed on means of egress doors in accordance with 780 CMR 1008.1.8.6, an automatic smoke or heat detection system shall be installed as required by 780 CMR 1008.1.8.6.

907.2.16 Aerosol Storage Uses. Aerosol storage rooms and general-purpose warehouses containing aerosols shall be provided with an approved manual fire alarm system where required by the International Fire Code and 527 CMR.

907.2.17 Lumber, Plywood and Veneer Mills. Lumber, plywood and veneer mills shall be provided with a manual fire alarm system.

907.2.18 Underground Buildings with Smoke Exhaust System. Where a smoke exhaust system is installed in an underground building in accordance with 780 CMR, automatic fire detectors shall be provided in accordance with 780 CMR 907.2.

907.2.18.1 Smoke Detectors. A minimum of one smoke detector listed for the intended purpose shall be installed in the following areas:

1. Mechanical equipment, electrical, transformer, telephone equipment, elevator machine or similar rooms.
2. Elevator lobbies.
3. The main return and exhaust air plenum of each air-conditioning system serving more than one story and located in a serviceable area downstream of the last duct inlet.
4. Each connection to a vertical duct or riser serving two or more floors from return air ducts or plenums of heating, ventilating and air-conditioning systems, except that in Group R occupancies, a listed smoke detector is allowed to be used in each return air riser carrying not more than 5,000 cfm (2.4 m^3/s) and serving not more than 10 air inlet openings.

907.2.18.2 Alarm Required. Activation of the smoke exhaust system shall activate an audible alarm at a constantly attended location and activate the alarm notification appliances throughout the building in accordance with 907.10.

907.2.19 Underground Buildings. Where the lowest level of a structure is more than 60 feet (18 288 mm) below the lowest level of exit discharge, the structure shall be equipped throughout with a manual fire alarm system, including an emergency voice/alarm communication system installed in accordance with 780 CMR 907.2.12.2.

907.2.19.1 Public Address System. Where a fire alarm system is not required by 780 CMR 907.2, a public address system shall be provided that shall be capable of transmitting voice communications to the highest level of exit discharge serving the underground portions of the structure and all levels below.

907.2.20 Covered Mall Buildings. Covered mall buildings exceeding 50,000 square feet (4645 m^2) in total floor area shall be provided with an emergency voice/alarm communication system. An emergency voice/alarm communication system serving a mall, required or otherwise, shall be accessible to the fire department. The system shall be provided in accordance with 780 CMR 907.2.12.2.

907.2.21 Residential Aircraft Hangars. A minimum of one listed ***heat detector*** shall be installed within a residential aircraft hangar as defined in 780 CMR 412.3.1 and shall be interconnected into the residential smoke alarm or other sounding device to provide an alarm that will be audible in all sleeping areas of the dwelling.

907.2.22 Airport Traffic Control Towers. An automatic fire detection system shall be provided in airport traffic control towers.

907.2.23 Battery Rooms. An approved automatic smoke detection system shall be installed in areas containing stationary lead-acid battery systems having a liquid capacity of more than 50 gallons (189.3 L). The detection system shall be supervised by an approved central, proprietary or remote station service or a local alarm that will sound an audible signal at a constantly attended location.

907.2.24 Buildings with Sleeping Areas. An automatic smoke detection system shall be provided for all sleeping areas, and means of egress from sleeping areas, of occupants not capable of self preservation in buildings not otherwise required to have smoke detectors by 780 CMR 907.2.1 through 780 CMR 907.2.23 where any space is used for sleeping purposes. Automatic smoke detection shall also be provided for sleeping areas where the occupants are not capable of self-preservation."

907.3 Manual Fire Alarm Boxes. Manual fire alarm boxes shall be installed in accordance with 780 CMR 907.3.1 through 907.3.5.

907.3.1 Location. Manual fire alarm boxes shall be located not more than five feet (1524 mm) from the entrance to each exit. Additional manual fire alarm boxes shall be located so that travel distance to the nearest box does not exceed 200 feet (60 960 mm).

907.3.2 Height. The height of the manual fire alarm boxes shall be a minimum of 42 inches (1067 mm) and a maximum of 48 inches (1219 mm), measured vertically, from the floor level to the activating handle or lever of the box.

907.3.3 Color. Manual fire alarm boxes shall be red in color.

907.3.4 Signs. Where fire alarm systems are not monitored by a supervising station, an approved permanent sign that reads: WHEN ALARM SOUNDS—CALL FIRE DEPARTMENT shall be installed adjacent to each manual fire alarm box.

Exception. Where the manufacturer has permanently provided this information on the manual fire alarm box.

907.3.5 Protective Covers. The building official ***or fire official*** is authorized to require the installation of listed manual fire alarm box protective covers to prevent malicious false alarms or provide the manual fire alarm box with protection from physical damage. The protective cover shall be transparent or red in color with a transparent face to permit visibility of the manual fire alarm box. Each cover shall include proper operating instructions. A protective cover that emits a local alarm signal shall not be installed unless approved.

907.4 Power Supply. The primary and secondary power supplies for the fire alarm system shall be provided in accordance with *NFPA 72*.

907.5 Wiring. Wiring shall comply with the requirements of *527 CMR 12.00* and *NFPA 72*. Wireless protection systems utilizing radio-frequency transmitting devices shall comply with the special requirements for supervision of low-power wireless systems in *NFPA 72*.

907.6 Activation. Where an alarm notification system is required by another section of 780 CMR, it shall be activated by:

1. A required automatic fire alarm system.
2. Sprinkler water-flow devices.
3. Required manual fire alarm boxes.
4. Other approved types of automatic fire detection devices, extinguishing, or suppression systems.

907.7 Presignal System. Presignal systems shall not be installed unless approved by the building official and the fire department. Where a presignal system is installed, 24-hour personnel supervision shall be provided at a location approved by the fire department, in order that the alarm signal can be actuated in the event of fire or other emergency.

907.8 Zones. Each floor shall be zoned separately and a zone shall not exceed 22,500 square feet (2090 m^2). The length of any zone shall not exceed 300 feet (91 440 mm) in any direction.

Exception. Automatic sprinkler system zones shall not exceed the area permitted by *NFPA 13*.

907.8.1 Zoning Indicator Panel. A zoning indicator panel and the associated controls shall be provided in an approved location. The visual zone indication shall lock in until the system is reset and shall not be canceled by the operation of an audible alarm-silencing switch.

907.8.2 High-rise Buildings. In buildings more than 70 feet in height above grade plane a separate zone by floor shall be provided for all of the following types of alarm-initiating devices where provided:

1. Smoke detectors.
2. Sprinkler water-flow devices.
3. Manual fire alarm boxes.
4. Other approved types of automatic fire detection devices or suppression systems.

907.9 Alarm Notification Appliances. Alarm notification appliances shall be provided and shall be listed for their purpose.

907.9.1 Visible Alarms. Visible alarm notification appliances shall be provided in accordance with 780 CMR 907.9.1.1 through 907.9.1.3 (also refer to 521 CMR requirements for visible alarms requirements in buildings or portions thereof, open to the public).

Exceptions:

1. Visible alarm notification appliances are not required in alterations, except where an existing fire alarm system is upgraded or replaced, or a new fire alarm system is installed (also refer to 521 CMR requirements for visible alarms requirements in buildings or portions thereof, open to the public).
2. Visible alarm notification appliances shall not be required in exits as defined in 780 CMR 1002.1 (also refer to 521 CMR requirements for visible alarms requirements in buildings or portions thereof, open to the public).

907.9.1.1 Public and Common Areas. Visible alarm notification appliances shall be provided in public areas and common areas (also refer to 521 CMR requirements for visible alarms requirements in buildings or portions thereof, open to the public).

907.9.1.2 Employee Work Areas. Where employee work areas have audible alarm coverage, the wiring systems shall be designed so that visible alarm notification appliances can be integrated into the alarm system.

907.9.1.3 Groups I and R. Refer to 521 CMR for requirements for visible alarms in Group I and R sleeping units – such visible alarm notification appliances shall activated by both the in-room smoke alarm and the building fire alarm system.

907.9.1.4 Group R-2. In Group R-2 occupancies required by 780 CMR 907.0 to have a fire alarm system, all dwelling units and sleeping units shall be provided with the capability to support visible alarm notification appliances in accordance with *ICC A117.1*.

907.9.2 Audible Alarms. Audible alarm notification appliances shall be provided and shall sound a distinctive sound that is not to be used for any purpose other than that of a fire alarm. The audible alarm notification appliances shall provide a sound pressure level in accordance with NFPA 72. Where the average ambient noise is greater than 105 dBA, visible alarm notification appliances shall be provided in accordance with *NFPA 72* and audible alarm notification appliances shall not be required.

Exception. Visible alarm notification appliances shall be allowed in lieu of audible alarm notification appliances in critical-care areas of Group I-2 occupancies.

907.10 Fire Safety Functions. Automatic fire detectors utilized for the purpose of performing fire safety functions shall be connected to the building's fire alarm control panel where a fire alarm system is required by 780 CMR 907.2. Detectors shall, upon actuation, perform the intended function and activate the alarm notification appliances and where provided a visible and audible supervisory signal at a constantly attended location. In buildings not required to be equipped with a fire alarm system, the automatic fire detector shall be powered by normal electrical service and, upon actuation, perform the intended function. The detectors shall be located in accordance with *NFPA 72*.

907.11 Duct Smoke Detectors. Duct smoke detectors shall be connected to the building's fire alarm control panel when a fire alarm system is provided. Activation of a duct smoke detector shall initiate a visible and audible supervisory signal at a constantly attended location. Duct smoke detectors shall not be used as a substitute for required open-area detection.

Exceptions:

1. The supervisory signal at a constantly attended location is not required where duct smoke detectors activate the building's alarm notification appliances.
2. In occupancies not required to be equipped with a fire alarm system, actuation of a smoke detector shall activate a visible and audible signal in an approved location. Smoke detector trouble conditions shall activate a visible or audible signal in an approved location and shall be identified as air duct detector trouble.
3. Duct smoke detectors may be used as a substitute for an open area protection in accordance 780 CMR 907.2.6.2.3

907.12 Access. Access shall be provided to each detector for periodic inspection, maintenance and testing.

907.13 Fire-extinguishing Systems. Automatic fire-extinguishing systems shall be connected to the building fire alarm system where a fire alarm system is required by another section of 780 CMR or is otherwise installed.

907.14 ***Supervising***.

907.14.1 Re-transmission of Alarm Signals Received by Central Stations and Received by Those Operating Approved Remote Station Fire Alarm System Supervising Stations. In all cases, central stations and those operating approved remote station fire alarm system supervising stations shall re-transmit alarm signals within 90 seconds of receipt, to the fire department having jurisdiction.

907.14.2 Fire Suppression Systems. All automatic fire suppression systems required by 780 CMR shall be supervised by one of the following methods in 780 CMR 907.14.2 Items 1. through 3.

1. A UL listed or FM approved Central Station Service in accordance with NFPA 72 listed in 780 CMR 35.00.
2. a. Approved propriety supervising station system, in accordance with NFPA 72 in accordance with NFPA 72 as listed in 780 CMR 35.00.
   b. Approved remote station fire alarm system supervising station in accordance with NFPA 72 as listed in 780 CMR 35.00.
3. Alarm signals to an approved Auxiliary Fire Alarm System in accordance with NFPA 72, with supervisory signals supervised by one or two above or at a constantly attended location approved by the local fire department, having personnel on duty trained to recognize the type of signal received and to take prescribed action. This shall be permitted to be a location different from that at which alarm signals are received.

Exceptions:

1. Underground gate valves with roadway boxes.
2. Halogenated extinguishing systems that are not an integral part of a required automatic fire suppression system.
3. Carbon dioxide extinguishing systems that are not an integral part of a required automatic fire suppression system.
4. Dry- and wet- chemical extinguishing systems
5. Limited area sprinkler systems (see 780 CMR 903.3.5.1.1)
6. Occupancies in use group R containing less than 13 dwelling units, no more than four stories in height and equipped with a suppression system conforming to NFPA and supervised in accordance with NFPA 13R listed in 780 CMR 35.00.

907.14.3 Fire Protective Signaling Systems and Automatic Fire Detection Systems. All fire protective signaling systems and automatic fire detection systems required by 780 CMR shall be supervised by one of the following methods below:

1. A UL listed or FM approved Central Station Service in accordance with NFPA 72 as listed 780 CMR 35.00.
2. a. Approved propriety supervising station system, in accordance with NFPA 72 as listed in 780 CMR 35.00.
   b. Approved remote station fire alarm system supervising station in accordance with NFPA 72 as listed in 780 CMR 35.00.
3. Alarm signals to an approved Auxiliary Fire Alarm System in accordance with NFPA 72, with supervisory signals supervised by one or two above or at a constantly attended location approved by the local fire department, having personnel on duty trained to recognize the type of signal received and to take prescribed action. This shall be permitted to

be a location different from that at which alarm signals are received.

Exceptions:

1. For use group R see Table 907.2.8
2. Single- and multi-station detectors as required by 780 CMR 5303.13
3. Smoke detectors in occupancies in use group I-3.
4. Smoke detectors in patient sleeping rooms in occupancies in Use Group I-2 (see 780 CMR 407.6).

907.14.4 Group H. Emergency alarm systems in Group H occupancies shall be monitored by an approved supervising station.

Exception. When approved by the Head of the Fire Department, on-site monitoring at a constantly attended location shall be permitted provided that notifications to the fire department will be equal to those provided by an approved supervising station.

907.15 Automatic Telephone-dialing Devices. Automatic telephone-dialing devices used to transmit an emergency alarm shall not be connected to any fire department telephone number unless approved by the fire chief.

907.16 Acceptance Tests. Upon completion of the installation of the fire alarm system, alarm notification appliances and circuits, alarm-initiating devices and circuits, supervisory-signal initiating devices and circuits, signaling line circuits, and primary and secondary power supplies shall be tested in accordance with *NFPA 72*.

907.17 Record of Completion. A record of completion in accordance with *NFPA 72* verifying that the system has been installed in accordance with the approved plans and specifications shall be provided.

907.18 Instructions. Operating, testing and maintenance instructions, and record drawings ("as builts") and equipment specifications shall be provided at an approved location.

907.19 Inspection, Testing and Maintenance. The maintenance and testing schedules and procedures for fire alarm and fire detection systems shall be in accordance with *NFPA 72.*

780 CMR 908.0 EMERGENCY ALARM SYSTEMS

908.1 Group H Occupancies. Emergency alarms for the detection and notification of an emergency condition in Group H occupancies shall be provided in accordance with 780 CMR 414.7.

908.2 Group H-5 Occupancy. Emergency alarms for notification of an emergency condition in an HPM facility shall be provided as required in 780 CMR 415.9.4.6. A continuous gas-detection system shall be provided for HPM gases in accordance with 780 CMR 415.9.7.

908.3 Highly Toxic and Toxic Materials. A gas detection system shall be provided for indoor storage and use of highly toxic and toxic gases to detect the presence of gas at or below the permissible exposure limit (PEL) or ceiling limit of the gas for which detection is provided. The system shall be capable of monitoring the discharge from the treatment system at or below one-half the IDLH limit.

Exception. A gas detection system is not required for toxic gases when the physiological warning properties are at a level below the accepted PEL for the gas.

908.3.1 Alarms. The gas detection system shall initiate a local alarm and transmit a signal to a constantly attended control station when a short-term hazard condition is detected. The alarm shall be both visible and audible and shall provide warning both inside and outside the area where gas is detected. The audible alarm shall be distinct from all other alarms.

Exception. Signal transmission to a constantly attended control station is not required when not more than one cylinder of highly toxic or toxic gas is stored.

908.3.2 Shutoff of Gas Supply. The gas detection system shall automatically close the shutoff valve at the source on gas supply piping and tubing related to the system being monitored for whichever gas is detected.

Exception. Automatic shutdown is not required for reactors utilized for the production of highly toxic or toxic compressed gases where such reactors are:

1. Operated at pressures less than 15 pounds per square inch gauge (psig) (103.4 kPa).
2. Constantly attended.
3. Provided with readily accessible emergency shutoff valves.

908.3.3 Valve Closure. The automatic closure of shutoff valves shall be in accordance with the following:

1. When the gas-detection sampling point initiating the gas detection system alarm is within a gas cabinet or exhausted enclosure, the shutoff valve in the gas cabinet or exhausted enclosure for the specific gas detected shall automatically close.
2. Where the gas-detection sampling point initiating the gas detection system alarm is within a gas room and compressed gas containers are not in gas cabinets or exhausted enclosures, the shutoff valves on all gas lines for the specific gas detected shall automatically close.

3. Where the gas-detection sampling point initiating the gas detection system alarm is within a piping distribution manifold enclosure, the shutoff valve for the compressed container of specific gas detected supplying the manifold shall automatically close.

Exception. When the gas-detection sampling point initiating the gas-detection system alarm is at a use location or within a gas valve enclosure of a branch line downstream of a piping distribution manifold, the shutoff valve in the gas valve enclosure for the branch line located in the piping distribution manifold enclosure shall automatically close.

908.4 Ozone Gas-generator Rooms. Ozone gas-generator rooms shall be equipped with a continuous gas-detection system that will shut off the generator and sound a local alarm when concentrations above the PEL occur.

908.5 Repair Garages. A flammable-gas detection system shall be provided in repair garages for vehicles fueled by nonodorized gases in accordance with 780 CMR 406.6.6.

908.6 Refrigerant Detector. Machinery rooms shall contain a refrigerant detector with an audible and visual alarm. The detector, or a sampling tube that draws air to the detector, shall be located in an area where refrigerant from a leak will concentrate. The alarm shall be actuated at a value not greater than the corresponding TLV-TWA values for the refrigerant classification indicated in the *International Mechanical Code*. Detectors and alarms shall be placed in approved locations.

Exception. Detectors are not required in ammonia system machinery rooms equipped with a vapor detector in accordance with the *International Mechanical Code*.

780 CMR 909.0 SMOKE CONTROL SYSTEMS

909.1 Scope and Purpose. 780 CMR 909.0 applies to mechanical or passive smoke control systems when they are required by other provisions of 780 CMR. The purpose of 780 CMR 909.0 is to establish minimum requirements for the design, installation and acceptance testing of smoke control systems that are intended to provide a tenable environment for the evacuation or relocation of occupants. These provisions are not intended for the preservation of contents, the timely restoration of operations or for assistance in fire suppression or overhaul activities. Smoke control systems regulated by 780 CMR 909.0 serve a different purpose than the smoke- and heat-venting provisions found in 780 CMR 910.0. Mechanical smoke control systems shall not be considered exhaust systems under Chapter 5 of the *International Mechanical Code*.

909.2 General Design Requirements. Buildings, structures or parts thereof required by 780 CMR to have a smoke control system or systems shall have such systems designed in accordance with the applicable requirements of 780 CMR 909.0 and the generally accepted and well-established principles of engineering relevant to the design. The construction documents shall include sufficient information and detail to adequately describe the elements of the design necessary for the proper implementation of the smoke control systems. These documents shall be accompanied by sufficient information and analysis to demonstrate compliance with these provisions.

909.3 Special Inspection and Test Requirements. In addition to the ordinary inspection and test requirements which buildings, structures and parts thereof are required to undergo, smoke control systems subject to the provisions of 780 CMR 909.0 shall undergo special inspections and tests sufficient to verify the proper commissioning of the smoke control design in its final installed condition. The design submission accompanying the construction documents shall clearly detail procedures and methods to be used and the items subject to such inspections and tests. Such commissioning shall be in accordance with generally accepted engineering practice and, where possible, based on published standards for the particular testing involved.

909.4 Analysis. A rational analysis supporting the types of smoke control systems to be employed, their methods of operation, the systems supporting them and the methods of construction to be utilized shall accompany the submitted construction documents and shall include, but not be limited to, the items indicated in 780 CMR 909.4.1 through 909.4.6.

909.4.1 Stack Effect. The system shall be designed such that the maximum probable normal or reverse stack effect will not adversely interfere with the system's capabilities. In determining the maximum probable stack effect, altitude, elevation, weather history and interior temperatures shall be used.

909.4.2 Temperature Effect of Fire. Buoyancy and expansion caused by the design fire in accordance with 780 CMR 909.9 shall be analyzed. The system shall be designed such that these effects do not adversely interfere with the system's capabilities.

909.4.3 Wind Effect. The design shall consider the adverse effects of wind. Such consideration shall be consistent with the wind-loading provisions of 780 CMR 16.00.

909.4.4 HVAC Systems. The design shall consider the effects of the heating, ventilating and air-conditioning (HVAC) systems on both smoke and fire transport. The analysis shall include all permutations of systems status. The design shall consider the effects of the fire on the HVAC systems.

909.4.5 Climate. The design shall consider the effects of low temperatures on systems, property and occupants. Air inlets and exhausts shall be located so as to prevent snow or ice blockage.

909.4.6 Duration of Operation. All portions of active or passive smoke control systems shall be capable of continued operation after detection of the fire event for not less than 20 minutes.

909.5 Smoke Barrier Construction. Smoke barriers shall comply with 780 CMR 709, and shall be constructed and sealed to limit leakage areas exclusive of protected openings. The maximum allowable leakage area shall be the aggregate area calculated using the following leakage area ratios:

1. Walls:$A/A_w = 0.00100$
2. Exit enclosures:$A/A_w = 0.00035$
3. All other shafts:$A/A_w = 0.00150$
4. Floors and roofs:$A/A_F = 0.00050$

where:

A= Total leakage area, square feet (m^2).

A_F= Unit floor or roof area of barrier, square feet (m^2).

A_w= Unit wall area of barrier, square feet (m^2).

The leakage area ratios shown do not include openings due to doors, operable windows or similar gaps. These shall be included in calculating the total leakage area.

909.5.1 Leakage Area. The total leakage area of the barrier is the product of the smoke barrier gross area monitored by the allowable leakage area ratio, plus the area of other openings such as gaps and operable windows. Compliance shall be determined by achieving the minimum air pressure difference across the barrier with the system in the smoke control mode for mechanical smoke control systems. Passive smoke control systems shall be tested using approved methods such as door fan testing.

909.5.2 Opening Protection. Openings in smoke barriers shall be protected by automatic-closing devices actuated by the required controls for the mechanical smoke control system. Door openings shall be protected by fire door assemblies complying with 780 CMR 715.3.3.

Exceptions:

1. Passive smoke control systems with automatic-closing devices actuated by spot-type smoke detectors listed for releasing service installed in accordance with 780 CMR 907.10.
2. Fixed openings between smoke zones which are protected utilizing the airflow method.
3. In Group I-2, where such doors are installed across corridors, a pair of opposite-swinging doors without a center mullion shall be installed having vision panels with approved fire-rated glazing materials in approved fire-rated frames, the area of which shall not exceed that tested. The doors shall be close fitting within operational tolerances and shall not have undercuts, louvers or grilles. The doors shall have head and jamb stops, astragals or rabbets at meeting edges, and automatic-closing devices. Positive-latching devices are not required.
4. Group I-3.
5. Openings between smoke zones with clear ceiling heights of 14 feet (4267 mm) or greater and bank-down capacity of greater than 20 minutes as determined by the design fire size.

909.5.2.1 Ducts and Air Transfer Openings. Ducts and air transfer openings are required to be protected with a minimum Class II, 250°F (121°C) smoke damper complying with 780 CMR 716.0.

909.6 Pressurization Method. The primary mechanical means of controlling smoke shall be by pressure differences across smoke barriers. Maintenance of a tenable environment is not required in the smoke control zone of fire origin.

909.6.1 Minimum Pressure Difference. The minimum pressure difference across a smoke barrier shall be 0.05-inch water gage (0.0124 kPa) in fully sprinklered buildings. In buildings permitted to be other than fully sprinklered, the smoke control system shall be designed to achieve pressure differences at least two times the maximum calculated pressure difference produced by the design fire.

909.6.2 Maximum Pressure Difference. The maximum air pressure difference across a smoke barrier shall be determined by required door-opening or closing forces. The actual force required to open exit doors when the system is in the smoke control mode shall be in accordance with 780 CMR 1008.1.2. Opening and closing forces for other doors shall be determined by standard engineering methods for the resolution of forces and reactions. The calculated force to set a side-hinged, swinging door in motion shall be determined by Equation 9-1:

Equation 9-1

$$F = F_{dc} + K(WADP)/2(W - d)$$

where:

A= Door area, square feet (m^2).

d= Distance from door handle to latch edge of door, feet (m).

F= Total door opening force, pounds (N).

F_{dc}= Force required to overcome closing device, pounds (N).

K= Coefficient 5.2 (1.0).

W= Door width, feet (m).

DP= Design pressure difference, inches of water (Pa).

909.7 Airflow Design Method. Smoke migration through openings fixed in a permanently open position, which are located between smoke control zones by the use of the airflow method, shall be permitted. The design airflow shall be in accordance with 780 CMR 909.7. Airflow shall be directed to limit smoke migration from the fire zone. The geometry of openings shall be considered to prevent flow reversal from turbulent effects.

909.7.1 Velocity. The minimum average velocity through a fixed opening shall not be less than:

Equation 9-2

$$v = 217.2\ [h\ (T_f - T_o)/(T_f + 460)]^{½}$$

For SI: $v = 119.9[h\ (T_f - T_o)/T_f]^{½}$

where:

h= Height of opening, feet (m).

T$_f$= Temperature of smoke, °F (°K).

T_o= Temperature of ambient air, °F (°K).

v= Air velocity, feet per minute (m/minute).

909.7.2 Prohibited Conditions. This method shall not be employed where either the quantity of air or the velocity of the airflow will adversely affect other portions of the smoke control system, unduly intensify the fire, disrupt plume dynamics or interfere with exiting. In no case shall airflow toward the fire exceed 200 feet per minute (1.02 m/s). Where the formula in 780 CMR 909.7.1 requires airflow to exceed this limit, the airflow method shall not be used.

909.8 Exhaust Method. Mechanical smoke control for large enclosed volumes, such as in atriums or malls, shall be permitted to utilize the exhaust method. The design exhaust volumes shall be in accordance with 780 CMR 909.8.

909.8.1 Exhaust Rate. The height of the lowest horizontal surface of the accumulating smoke layer shall be maintained at least ten feet (3048 mm) above any walking surface which forms a portion of a required egress system within the smoke zone. The required exhaust rate for the zone shall be the largest of the calculated plume mass flow rates for the possible plume configurations. Provisions shall be made for natural or mechanical supply of air from outside or adjacent smoke zones to make up for the air exhausted. Makeup airflow rates, when measured at the potential fire location, shall not exceed 200 feet per minute (60 960 mm per minute) toward the fire. The temperature of the makeup air shall be such that it does not expose temperature-sensitive fire protection systems beyond their limits.

909.8.2 Axisymmetric Plumes. The plume mass flow rate (m_p), in pounds per second (kg/s), shall be determined by placing the design fire center on the axis of the space being analyzed. The limiting flame height shall be determined by:

Equation 9-3

$$z_l = 0.533Q_c^{2/5}$$

For SI: $z_l = 0.166Q_c^{2/5}$

where:

m_p= Plume mass flow rate, pounds per second (kg/s).

Q= Total heat output.

Q_c= Convective heat output, British thermal units per second (kW). (The value of Q_c shall not be taken as less than $0.70Q$).

z= Height from top of fuel surface to bottom of smoke layer, feet (m).

z_l= Limiting flame height, feet (m). The z_l value must be greater than the fuel equivalent diameter (see 780 CMR 909.9).

for $z > z_l$

$m_p = 0.022Q_c^{1/3}z^{5/3} + 0.0042Q_c$

For SI: $m_p = 0.071\ Q_c^{1/3}z^{5/3} + 0.0018Q_c$

for $z = z_l$

$m_p = 0.011\ Q_c$

For SI: $m_p = 0.035Q_c$

for $z < z_l$

$m_p = 0.0208Q_c^{3/5}z$

For SI: $m_p = 0.032Q_c^{3/5}z$

To convert m_p from pounds per second of mass flow to a volumetric rate, the following equation shall be used:

Equation 9-4

$$V = 60\ m_p/\rho$$

where:

V= Volumetric flow rate, cubic feet per minute (m^3/s).

ρ = Density of air at the temperature of the smoke layer, pounds per cubic feet (T: in °F) [kg/m^3 (T: in °C)].

909.8.3 Balcony spill plumes. The plume mass flow rate (m_p) for spill plumes shall be determined using the geometrically probable width based on architectural elements and projections in the following equation:

Equation 9-5

$m_p = 0.124(QW^2)^{1/3}(z_b + 0.25H)$ **(Equation 9-5)**

For SI: $m_p = 0.36(QW^2)^{1/3}(z_b + 0.25H)$

where:

H= Height above fire to underside of balcony, feet (m).

m_p= Plume mass flow rate, pounds per second (kg/s).

Q= Total heat output.

W= Plume width at point of spill, feet (m).

z_b= Height from balcony, feet (m).

909.8.4 Window Plumes. The plume mass flow rate (m_p) shall be determined from:

Equation 9-6

$m_p = 0.077(A_wH_w^{1/2})^{1/3}(z_w+a)^{5/3} + 0.18A_wH_w^{1/2}$

For SI: $m_p = 0.68(A_wH_w^{1/2})^{1/3}(z_w + a)^{5/3} + 1.5A_wH_w^{1/2}$

where:

A_w= Area of the opening, square feet (m²).

H_w= Height of the opening, feet (m).

m_p= plume mass flow rate, pounds per second (kg/s).

z_w= Height from the top of the window or opening to the bottom of the smoke layer, feet (m).

$a= 2.4A_w^{2/5}H_w^{1/5} - 2.1H_w$.

909.8.5 Plume Contact with Walls. When a plume contacts one or more of the surrounding walls, the mass flow rate shall be adjusted for the reduced entrainment resulting from the contact provided that the contact remains constant. Use of this provision requires calculation of the plume diameter, that shall be calculated by:

Equation 9-7

$d = 0.48\ [(T_c + 460)/(T_a + 460)]^{1/2}z$

For SI: $d = 0.48\ (T_c/T_a)^{1/2}z$

where:

d = Plume diameter, feet (m).

T_a= Ambient air temperature, °F (°°K).

T_c= Plume centerline temperature, °F (°K).

$= 0.60\ (T_a + 460)_{Qc}{}^{2/3}z^{-5/3} + T_a$

z= Height at which T_c is determined, feet (m).

For SI: $T_c = 0.08\ T_a\ Qc^{2/3}\ z^{-5/3} + T_a$

909.9 Design Fire. The design fire shall be based on a Q of not less than 5,000 Btu/s (5275 kW) unless a rational analysis is performed by the registered design professional. The design fire shall be based on the analysis in accordance with 780 CMR 909.4 and 780 CMR 909.9.

909.9.1 Factors Considered. The engineering analysis shall include the characteristics of the fuel, fuel load, effects included by the fire and whether the fire is likely to be steady or unsteady.

909.9.2 Separation Distance. Determination of the design fire shall include consideration of the type of fuel, fuel spacing and configuration. The ratio of the separation distance to the fuel equivalent radius shall not be less than four. The fuel equivalent radius shall be the radius of a circle of equal area to floor area of the fuel package. The design fire shall be increased if other combustibles are within the separation distance as determined by:

Equation 9-8

$R = [Q/(12pq'')]^{1/2}$

where:

q = Incident radiant heat flux required for nonpiloted ignition, Btu/ft² _ s (W/m²).

Q = Heat release from fire, Btu/s (kW).

R = Separation distance from target to center of fuel package, feet (m).

909.9.3 Heat-release Assumptions. The analysis shall make use of best available data from approved sources and shall not be based on excessively stringent limitations of combustible material.

909.9.4 Sprinkler Effectiveness Assumptions. A documented engineering analysis shall be provided for conditions that assume fire growth is halted at the time of sprinkler activation.

909.10 Equipment. Equipment such as, but not limited to, fans, ducts, automatic dampers and balance dampers, shall be suitable for its intended use, suitable for the probable exposure temperatures that the rational analysis indicates.

909.10.1 Exhaust Fans. Components of exhaust fans shall be rated and certified by the manufacturer for the probable temperature rise to which the components will be exposed. This temperature rise shall be computed by:

Equation 9-9

$T_s = (Q_c/mc) + (T_a)$

where:

c= Specific heat of smoke at smoke layer temperature, Btu/lb°F (kJ/kg • K).

m= Exhaust rate, pounds per second (kg/s).

Q_c= Convective heat output of fire, Btu/s (kW).

T_a= Ambient temperature, °F (°K).

T_s= Smoke temperature, °F (°K).

Exception. Reduced T_s as calculated based on the assurance of adequate dilution air.

909.10.2 Ducts. Duct materials and joints shall be capable of withstanding the probable temperatures and pressures to which they are exposed as determined in accordance with 780 CMR 909.10.1. Ducts shall be constructed and supported in accordance with the *International Mechanical Code*. Ducts shall be leak tested to 1.5 times the maximum design pressure in accordance with nationally accepted practices. Measured leakage shall not exceed 5%

of design flow. Results of such testing shall be a part of the documentation procedure. Ducts shall be supported directly from fire-resistance-rated structural elements of the building by substantial, noncombustible supports.

Exception. Flexible connections (for the purpose of vibration isolation) complying with the *International Mechanical Code*, that are constructed of approved fire-resistance-rated materials.

909.10.3 Equipment, Inlets and Outlets. Equipment shall be located so as to not expose uninvolved portions of the building to an additional fire hazard. Outside air inlets shall be located so as to minimize the potential for introducing smoke or flame into the building. Exhaust outlets shall be so located as to minimize reintroduction of smoke into the building and to limit exposure of the building or adjacent buildings to an additional fire hazard.

909.10.4 Automatic Dampers. Automatic dampers, regardless of the purpose for which they are installed within the smoke control system, shall be listed and conform to the requirements of approved, recognized standards.

909.10.5 Fans. In addition to other requirements, belt-driven fans shall have 1.5 times the number of belts required for the design duty, with the minimum number of belts being two. Fans shall be selected for stable performance based on normal temperature and, where applicable, elevated temperature. Calculations and manufacturer's fan curves shall be part of the documentation procedures. Fans shall be supported and restrained by noncombustible devices in accordance with the requirements of 780 CMR 16.00. Motors driving fans shall not be operated beyond their nameplate horsepower (kilowatts), as determined from measurement of actual current draw, and shall have a minimum service factor of 1.15.

909.11 Power Systems. The smoke control system shall be supplied with two sources of power. Primary power shall be the normal building power systems. Secondary power shall be from an approved standby source complying with 527 CMR 12.00 as listed in 780 CMR 35.00 The standby power source and its transfer switches shall be in a separate room from the normal power transformers and switch gear and shall be enclosed in a room constructed of not less than one-hour fire-resistance-rated fire barriers ventilated directly to and from the exterior. Power distribution from the two sources shall be by independent routes. Transfer to full standby power shall be automatic and within 60 seconds of failure of the primary power. The systems shall comply with 527 CMR 12.00 as listed in 780 CMR 35.00.

909.11.1 Power Sources and Power Surges. Elements of the smoke management system relying on volatile memories or the like shall be supplied with uninterruptable power sources of sufficient duration to span a 15-minute primary power interruption. Elements of the smoke management system susceptible to power surges shall be suitably protected by conditioners, suppressors or other approved means.

909.12 Detection and Control Systems. Fire detection systems providing control input or output signals to mechanical smoke control systems or elements thereof shall comply with the requirements of 780 CMR 907.0. Such systems shall be equipped with a control unit complying with UL 864 and listed as smoke control equipment.

Control systems for mechanical smoke control systems shall include provisions for verification. Verification shall include positive confirmation of actuation, testing, manual override, the presence of power downstream of all disconnects and, through a preprogrammed weekly test sequence report, abnormal conditions audibly, visually and by printed report.

909.12.1 Wiring. In addition to meeting requirements of 527 CMR as listed in 780 CMR 35.00; all wiring, regardless of voltage, shall be fully enclosed within continuous raceways.

909.12.2 Activation. Smoke control systems shall be activated in accordance with 780 CMR 909.12.

909.12.2.1 Pressurization, Airflow or Exhaust Method. Mechanical smoke control systems using the pressurization, airflow or exhaust method shall have completely automatic control.

909.12.2.2 Passive Method. Passive smoke control systems actuated by approved spot-type detectors listed for releasing service shall be permitted.

909.12.3 Automatic Control. Where completely automatic control is required or used, the automatic-control sequences shall be initiated from an appropriately zoned automatic sprinkler system complying with 780 CMR 903.3.1.1, manual controls that are readily accessible to the fire department and any smoke detectors required by engineering analysis.

909.13 Control Air Tubing. Control air tubing shall be of sufficient size to meet the required response times. Tubing shall be flushed clean and dry prior to final connections and shall be adequately supported and protected from damage. Tubing passing through concrete or masonry shall be sleeved and protected from abrasion and electrolytic action.

909.13.1 Materials. Control air tubing shall be hard drawn copper, Type L, ACR in accordance with *ASTM B 42, ASTM B 43, ASTM B 68, ASTM*

B 88, *ASTM B 251* and *ASTM B 280*. Fittings shall be wrought copper or brass, solder type, in accordance with *ASME B 16.18* or *ASME B 16.22*. Changes in direction shall be made with appropriate tool bends. Brass compression-type fittings shall be used at final connection to devices; other joints shall be brazed using a BCuP5 brazing alloy with solidus above 1,100°F (593°C) and liquids below 1,500°F (816°C). Brazing flux shall be used on copper-to-brass joints only.

Exception. Nonmetallic tubing used within control panels and at the final connection to devices, provided that all of the following conditions are met:

1. Tubing shall be listed by an approved agency for flame and smoke characteristics.
2. Tubing and connected devices shall be completely enclosed within galvanized or paint-grade steel enclosure of not less than 0.030 inch (0.76 mm) (No. 22 galvanized sheet gage) thickness. Entry to the enclosure shall be by copper tubing with a protective grommet of neoprene or teflon or by suitable brass compression to male-barbed adapter.
3. Tubing shall be identified by appropriately documented coding.
4. Tubing shall be neatly tied and supported within enclosure. Tubing bridging cabinet and door or moveable device shall be of sufficient length to avoid tension and excessive stress. Tubing shall be protected against abrasion. Tubing serving devices on doors shall be fastened along hinges.

909.13.2 Isolation from Other Functions. Control tubing serving other than smoke control functions shall be isolated by automatic isolation valves or shall be an independent system.

909.13.3 Testing. Control air tubing shall be tested at three times the operating pressure for not less than 30 minutes without any noticeable loss in gauge pressure prior to final connection to devices.

909.14 Marking and Identification. The detection and control systems shall be clearly marked at all junctions, accesses and terminations.

909.15 Control Diagrams. Identical control diagrams showing all devices in the system and identifying their location and function shall be kept on site readily accessible for inspection by the building and fire official. The format and manner of the control diagrams shall be subject to approval by the fire official.

909.16 Fire-fighter's Smoke Control Panel. A fire-fighter's smoke control panel for fire department emergency response purposes only shall be provided and shall include manual control or override of automatic control for mechanical smoke control systems.The panel shall be located in a location approved by the fire department and the panel shall comply with780 CMR 909.16.1 through 909.16.3. In buildings provided with a fire command center, the smoke control panel shall be located within the fire command center complying with 780 CMR 911.

909.16.1 Smoke Control Systems. Fans used or intended for smoke control purposes shall be shown on the fire-fighter's control panel. A clear indication of the direction of airflow and the relationship of components shall be displayed. Status indicators shall be provided for all smoke control equipment, annunciated by fan and zone, and by pilot-lamp-type indicators as follows:

1. Fans, dampers and other operating equipment in their normal status—WHITE.
2. Fans, dampers and other operating equipment in their off or closed status—RED.
3. Fans, dampers and other operating equipment in their on or open status—GREEN.
4. Fans, dampers and other operating equipment in a fault status—YELLOW/AMBER.

909.16.2 Smoke Control Panel. The fire-fighter's control panel shall provide control capability over the complete smoke-control system equipment within the building as follows:

1. ON-AUTO-OFF control over each individual piece of operating smoke control equipment that can also be controlled from other sources within the building. This may include stairway pressurization fans; smoke exhaust fans; supply, return and exhaust fans; elevator shaft fans and other operating equipment used or intended for smoke control purposes.
2. OPEN-AUTO-CLOSE control over individual dampers relating to smoke control and that are also controlled from other sources within the building.
3. ON-OFF or OPEN-CLOSE control over smoke control and other critical equipment associated with a fire or smoke emergency and that can only be controlled from the fire-fighter's control panel.

Exceptions:

1. Complex systems, where approved, where the controls and indicators are combined to control and indicate all elements of a single smoke zone as a unit.
2. Complex systems, where approved, where the control is accomplished by computer interface using approved, plain English commands.

909.16.3 Control Action and Priorities. The fire-fighter's control panel actions shall be as follows:

1. ON-OFF, OPEN-CLOSE control actions shall have the highest priority of any control point within the building. Once issued from the fire-fighter's control panel, no automatic or

manual control from any other control point within the building shall contradict the control action. Where automatic means are provided to interrupt normal, non emergency equipment operation or produce a specific result to safeguard the building or equipment (i.e., duct freeze stats, duct smoke detectors, high-temperature cutouts, temperature-actuated linkage and similar devices), such means shall be capable of being overridden by the fire-fighter's control panel. The last control action as indicated by each fire-fighter's control panel switch position shall prevail. In no case shall control actions require the smoke control system to assume more than one configuration at any one time.

Exception. Power disconnects required by 527 CMR 12.00 as listed in 780 CMR 35.00.

2. Only the AUTO position of each three-position fire-fighter's control panel switch shall allow automatic or manual control action from other control points within the building. The AUTO position shall be the NORMAL, non emergency, building control position. Where a fire-fighter's control panel is in the AUTO position, the actual status of the device (on, off, open, closed) shall continue to be indicated by the status indicator described above. When directed by an automatic signal to assume an emergency condition, the NORMAL position shall become the emergency condition for that device or group of devices within the zone. In no case shall control actions require the smoke control system to assume more than one configuration at any one time.

909.17 System Response Time. Smoke-control system activation shall be initiated immediately after receipt of an appropriate automatic or manual activation command. Smoke control systems shall activate individual components (such as dampers and fans) in the sequence necessary to prevent physical damage to the fans, dampers, ducts and other equipment. For purposes of smoke control, the fire-fighter's control panel response time shall be the same for automatic or manual smoke control action initiated from any other building control point. The total response time, including that necessary for detection, shutdown of operating equipment and smoke control system startup, shall allow for full operational mode to be achieved before the conditions in the space exceed the design smoke condition. The system response time for each component and their sequential relationships shall be detailed in the required rational analysis and verification of their installed condition reported in the required final report.

909.18 Acceptance Testing. Devices, equipment, components and sequences shall be individually tested. These tests, in addition to those required by other provisions of 780 CMR, shall consist of determination of function, sequence and, where applicable, capacity of their installed condition.

909.18.1 Detection Devices. Smoke or fire detectors that are a part of a smoke control system shall be tested in accordance with 780 CMR 9.00 in their installed condition. When applicable, this testing shall include verification of airflow in both minimum and maximum conditions.

909.18.2 Ducts. Ducts that are part of a smoke control system shall be traversed using generally accepted practices to determine actual air quantities.

909.18.3 Dampers. Dampers shall be tested for function in their installed condition.

909.18.4 Inlets and Outlets. Inlets and outlets shall be read using generally accepted practices to determine air quantities.

909.18.5 Fans. Fans shall be examined for correct rotation. Measurements of voltage, amperage, revolutions per minute (rpm) and belt tension shall be made.

909.18.6 Smoke Barriers. Measurements using inclined manometers or other approved calibrated measuring devices shall be made of the pressure differences across smoke barriers. Such measurements shall be conducted for each possible smoke control condition.

909.18.7 Controls. Each smoke zone, equipped with an automatic-initiation device, shall be put into operation by the actuation of one such device. Each additional device within the zone shall be verified to cause the same sequence without requiring the operation of fan motors in order to prevent damage. Control sequences shall be verified throughout the system, including verification of override from the fire-fighter's control panel and simulation of standby power conditions.

909.18.8 Special Inspections for Smoke Control. Smoke control systems shall be tested by a special inspector.

909.18.8.1 Scope of Testing. Special inspections shall be conducted in accordance with the following:

1. During erection of ductwork and prior to concealment for the purposes of leakage testing and recording of device location.
2. Prior to occupancy and after sufficient completion for the purposes of pressure-difference testing, flow measurements, and detection and control verification.

909.18.8.2 Qualifications. Special inspection agencies for smoke control shall have expertise in fire protection engineering, mechanical engineering and certification as air balancers.

909.18.8.3 Reports. A complete report of testing shall be prepared by the special inspector or special inspection agency. The report shall include identification of all devices by manufacturer, nameplate data, design values, measured values and identification tag or mark. The report shall be reviewed by the responsible registered design professional and, when satisfied that the design intent has been achieved, the responsible registered design professional shall seal, sign and date the report.

909.18.8.3.1 Report Filing. A copy of the final report shall be filed with the building official and fire official and an identical copy shall be maintained in an approved location at the building.

909.18.9 Identification and documentation. Charts, drawings and other documents identifying and locating each component of the smoke control system, and describing its proper function and maintenance requirements, shall be maintained on file at the building as an attachment to the report required by 780 CMR 909.18.8.3. Devices shall have an approved identifying tag or mark on them consistent with the other required documentation and shall be dated indicating the last time they were successfully tested and by whom.

909.19 System Acceptance. Buildings, or portions thereof, required by 780 CMR to comply with 780 CMR 909.19 shall not be issued a certificate of occupancy until such time that the building official determines that the provisions of 780CMR 909.19 have been fully complied with, and after the building official an fire official or their designees have witnessed and approved a satisfactory functional test of the smoke control system, and that the fire department has received satisfactory instruction on the operation, both automatic and manual, of the system.

Exception. In buildings of phased construction, a temporary certificate of occupancy, as approved by the building official, shall be permitted provided that those portions of the building to be occupied meet the requirements of 780 CMR 909.19 and that the remainder does not pose a significant hazard to the safety of the proposed occupants or adjacent buildings.

909.20 Smokeproof Enclosures. Where required by other sections of 780 CMR, a smokeproof enclosure shall be constructed in accordance with780 CMR 909.20. A smokeproof enclosure shall consist of an enclosed interior exit stairway that conforms to 780 CMR 1019.1 and an outside balcony or ventilated vestibule meeting the requirements of 780 CMR 909.20. Where access to the roof is required, such access shall be from the smokeproof enclosure where a smokeproof enclosure is required.

909.20.1 Access. Access to the stair shall be by way of a vestibule or an open exterior balcony. The minimum dimension of the vestibule shall not be less than the required width of the corridor leading to the vestibule but shall not have a width of less than 44 inches (1118 mm) and shall not have a length of less than 72 inches (1829 mm) in the direction of egress travel.

909.20.2 Construction. The smokeproof enclosure shall be separated from the remainder of the building by not less than a two-hour fire-resistance-rated fire barrier without openings other than the required means of egress doors. The vestibule shall be separated from the stairway by not less than a two-hour fire-resistance-rated fire barrier. The open exterior balcony shall be constructed in accordance with the fire-resistance-rating requirements for floor construction.

909.20.2.1 Door Closers. Doors in a smokeproof enclosure shall be self-closing or automatic-closing by actuation of a smoke detector installed at the floor-side entrance to the smokeproof enclosure in accordance with 780 CMR 715.3.7. The actuation of the smoke detector on any door shall activate the closing devices on all doors in the smokeproof enclosure at all levels. Smoke detectors shall be installed in accordance with 780 CMR 907.10.

909.20.3 Natural Ventilation Alternative. The provisions of 780CMR 909.20.3.1 through 909.20.3.3 shall apply to ventilation of smokeproof enclosures by natural means.

909.20.3.1 Balcony Doors. Where access to the stairway is by way of an open exterior balcony, the door assembly into the enclosure shall be a fire door in accordance with 780 CMR 715.3.

909.20.3.2 Vestibule Doors. Where access to the stairway is by way of a vestibule, the door assembly into the vestibule shall be a fire door complying with 780 CMR 715.3. The door assembly from the vestibule to the stairway shall have not less than a 20-minute fire protection rating complying with 780 CMR 715.3.

909.20.3.3 Vestibule Ventilation. Each vestibule shall have a minimum net area of 16 square feet (1.5 m^2) of opening in a wall facing an outer court, yard or public way that is at least 20 feet (6096 mm) in width.

909.20.4 Mechanical Ventilation Alternative. The provisions of 780 CMR 909.20.4.1 through 909.20.4.4 shall apply to ventilation of smokeproof enclosures by mechanical means.

909.20.4.1 Vestibule Doors. The door assembly from the building into the vestibule shall be a fire door complying with 780 CMR 715.3. The door assembly from the vestibule to the stairway shall have not less than a 20-minute fire protection rating in accordance with 780 CMR 715.3. The door from the building into the vestibule shall be provided with gaskets or other provisions to minimize air leakage.

909.20.4.2 Vestibule Ventilation. The vestibule shall be supplied with not less than one air change per minute and the exhaust shall not be less than 150% of supply. Supply air shall enter and exhaust air shall discharge from the vestibule through separate, tightly constructed ducts used only for that purpose. Supply air shall enter the vestibule within six inches (152 mm) of the floor level. The top of the exhaust register shall be located at the top of the smoke trap but not more than six inches (152 mm) down from the top of the trap, and shall be entirely within the smoke trap area. Doors in the open position shall not obstruct duct openings. Duct openings with controlling dampers are permitted where necessary to meet the design requirements, but dampers are not otherwise required.

909.20.4.2.1 Engineered Ventilation System. Where a specially engineered system is used, the system shall exhaust a quantity of air equal to not less than 90 air changes per hour from any vestibule in the emergency operation mode and shall be sized to handle three vestibules simultaneously. Smoke detectors shall be located at the floor-side entrance to each vestibule and shall activate the system for the affected vestibule. Smoke detectors shall be installed in accordance with 780 CMR 907.10.

909.20.4.3 Smoke Trap. The vestibule ceiling shall be at least 20 inches (508 mm) higher than the door opening into the vestibule to serve as a smoke and heat trap and to provide an upward-moving air column. The height shall not be decreased unless approved and justified by design and test.

909.20.4.4 Stair Shaft Air Movement System. The stair shaft shall be provided with a dampered relief opening and supplied with sufficient air to maintain a minimum positive pressure of 0.10 inch of water (25 Pa) in the shaft relative to the vestibule with all doors closed.

909.20.5 Stair Pressurization Alternative. Where the building is equipped throughout with an automatic sprinkler system in accordance with 780 CMR 903.3.1.1, the vestibule is required for a minimum of one stair but is not required for other stairs, provided that the interior exit stairways are pressurized to a minimum of 0.15 inch of water (37 Pa) and a maximum of 0.35 inch of water (87 Pa) in the shaft relative to the building measured with all stairway doors closed under maximum anticipated stack pressures.

909.20.6 Ventilating Equipment. The activation of ventilating equipment required by the alternatives in 780 CMR 909.20.4 and 909.20.5 shall be by smoke detectors installed at each floor level at an approved location at the entrance to the smokeproof enclosure. When the closing device for the stair shaft and vestibule doors is activated by smoke detection or power failure, the mechanical equipment shall activate and operate at the required performance levels. Smoke detectors shall be installed in accordance with 780 CMR 907.10.

909.20.6.1 Ventilation Systems.

909.20.6.1.1 Smokeproof enclosure ventilation systems shall be independent of other building ventilation systems. The equipment and ductwork shall comply with one of the following:

1. Equipment and ductwork shall be located exterior to the building and directly connected to the smokeproof enclosure or connected to the smokeproof enclosure by ductwork enclosed by two-hour fire-resistance-rated fire barriers.
2. Equipment and ductwork shall be located within the smokeproof enclosure with intake or exhaust directly from and to the outside or through ductwork enclosed by two-hour fire-resistance-rated fire barriers.
3 .Equipment and ductwork shall be located within the building if separated from the remainder of the building, including other mechanical equipment, by two-hour fire-resistance-rated fire barriers.

909.20.6.1.2 In-take Duct Detection. An in-duct smoke detector shall be installed upstream of all fresh air intakes and before entering the smoke-proof enclosure. Annunciation of activation shall occur at the control panel required by 780 CMR 909.21.2.2.

909.20.6.2 Standby Power. Mechanical vestibule and stair shaft ventilation systems and automatic fire detection systems shall be powered by an approved standby power system conforming to 780 CMR 403.10.1 and 780 CMR 27.

909.20.6.3 Acceptance and Testing. Before the mechanical equipment is approved, the system shall be tested in the presence of the building official and fire official or their designees to confirm that the system is operating in compliance with these requirements.

909.21 Underground Building Smoke Exhaust System. Where required in accordance with 780 CMR 405.5 for underground buildings, a smoke exhaust system shall be provided in accordance with 780 CMR 909.21.

909.21.1 Exhaust Capability. Where compartmentation is required, each compartment shall have an independent, automatically activated smoke exhaust system capable of manual operation. The system shall have an air supply and smoke exhaust capability that will provide a minimum of six air changes per hour.

909.21.2 Operation.

909.21.2.1 The smoke exhaust system shall be operated in the compartment of origin by the following, independently of each other:

1. Two cross-zoned smoke detectors within a single protected area of a single smoke detector monitored by an alarm verification zone or an approved equivalent method.
2. The automatic sprinkler system.

909.21.2.2. ON-AUTO-OFF controls shall be installed in a location approved by the fire department.

909.21.3 Alarm Required. Activation of the smoke exhaust system shall activate an audible alarm at a constantly attended location.

780 CMR 910.0 SMOKE AND HEAT VENTS

910.1 General. Where required by 780 CMR or otherwise installed, smoke and heat vents or mechanical smoke exhaust systems and draft curtains shall conform to the requirements of 780 CMR 910.0.

Exception. Frozen-food warehouses used solely for storage of Class I and II commodities where protected by an approved automatic sprinkler system.

910.2 Where Required. Approved smoke and heat vents, and draft curtains, shall be installed in the roofs of one-story buildings or portions thereof occupied for the uses set forth in 780CMR 910.2.1 through 910.2.4.

910.2.1 Groups F-1 and S-1. Buildings and portions thereof used as a Group F-1 or S-1 occupancy having more than 50,000 square feet (4645 m^2) in undivided area.

Exception . Group S-1 aircraft repair hangars.

910.2.2 Group H. Buildings and portions thereof used as a Group H occupancy as shown:

1. In occupancies classified as Group H-2 or H-3, any of which are over 15,000 square feet (1394 m^2) in single floor area.

   Exception. Buildings of noncombustible construction containing only noncombustible materials.

2. In areas of buildings in Group H used for storing Class 2, 3, and 4 liquid and solid oxidizers, Class 1 and unclassified detonable organic peroxides, Class 3 and 4 unstable (reactive) materials, or Class 2 or 3 water-reactive materials as required for a high-hazard commodity classification.

   Exception. Buildings of noncombustible construction containing only noncombustible materials.

910.2.3 High-piled Combustible Storage. Buildings and portions thereof containing high-piled combustible stock or rack storage in any occupancy group in accordance with 780 CMR 413.

910.2.4 Exit access Travel Distance Increase. Buildings and portions thereof used as a Group F-1 or S-1 occupancy where the maximum exit access travel distance is increased in accordance with 780 CMR 1015.2.

910.3 Design and Installation. The design and installation of smoke and heat vents and draft curtains shall be as specified in 780 CMR 910.0 and Table 910.3.

910.3.1 Vent Operation. Smoke and heat vents shall be approved and labeled and shall be capable of being operated by approved automatic and manual means. Automatic operation of smoke and heat vents shall conform to the provisions of 780 CMR 910.3.

910.3.1.1 Gravity-operated Drop-out Vents. Automatic smoke and heat vents containing heat-sensitive glazing designed to shrink and drop out of the vent opening when exposed to fire shall fully open within five minutes after the vent cavity is exposed to a simulated fire, represented by a time-temperature gradient that reaches an air temperature of 500°F (260°C) within five minutes.

910.3.1.2 Sprinklered Buildings. Where installed in buildings provided with an approved automatic sprinkler system, smoke and heat vents shall be designed to operate manually.

910.3.1.3 Nonsprinklered Buildings. Where installed in buildings not provided with an approved automatic sprinkler system, smoke and heat vents shall operate automatically by actuation of a heat-responsive device rated at between 100°F (38°C) and 220°F (104°C) above ambient.

Exception. Gravity-operated drop-out vents complying with 780 CMR 910.3.1.1

TABLE 910.3 REQUIREMENTS FOR DRAFT CURTAINS AND SMOKE AND HEAT VENTS

OCCUPANCY GROUP AND COMMODITY CLASSIFICATION	DESIGNATED STORAGE HEIGHT (feet)	MINIMUM DRAFT CURTAIN DEPTH (feet)	MAXIMUM AREA FORMED BY DRAFT CURTAINS (square feet)	VENT AREA TO FLOOR AREA RATIO	MAXIMUM SPACING OF VENT CENTERS (feet)	MAXIMUM DISTANCE TO VENTS FROM WALL OR DRAFT CURTAINS[b] (feet)
Group F-1	—	$0.2 \times H^c$ but ≥ 4	50,000	1:100	120	60
Group S-1 I-IV (Option 1)	≤ 20	6	10,000	1:100	100	60
	> 20 ≤ 40	6	8,000	1:75	100	55
Group S-1 I-IV (Option 2)	≤ 20	4	3,000	1:75	100	55
	> 20 ≤ 40	4	3,000	1:50	100	50
Group S-1 High hazard (Option 1)	≤ 20	6	6,000	1:50	100	50
	> 20 ≤ 30	6	6,000	1:40	90	45
Group S-1 High hazard (Option 2)	≤ 20	4	4,000	1:50	100	50
	> 20 ≤ 30	4	2,000	1:30	75	40

For SI: 1 foot = 304.8 mm, 1 square foot = 0.0929 m^2.

a. Requirements for rack storage heights in excess of those indicated shall be in accordance with Chapter 23 of the *International Fire Code*. For solid-piled storage heights in excess of those indicated, an approved engineered design shall be used.

b. The distance specified is the maximum distance from any vent in a particular draft curtained area to walls or draft curtains which form the perimeter of the draft curtained area.

c. H is the height of the vent, in feet, above the floor.

910.3.2 Vent Dimensions. The effective venting area shall not be less than 16 square feet (1.5 m^2) with no dimension less than four feet (1219 mm), excluding ribs or gutters having a total width not exceeding six inches (152 mm).

910.3.3 Vent Locations. Smoke and heat vents shall be located 20 feet (6096 mm) or more from adjacent lot lines and fire walls and ten feet (3048 mm) or more from fire barrier walls. Vents shall be uniformly located within the roof area above high-piled storage areas, with consideration given to roof pitch, draft curtain location, sprinkler location and structural members.

910.3.4 Draft Curtains. Where required, draft curtains shall be provided in accordance with 780 CMR 910.3.

Exception. Where areas of buildings are equipped with automatic sprinklers throughout.

910.3.4.1 Construction. Draft curtains shall be constructed of sheet metal, lath and plaster, gypsum board or other approved materials which provide equivalent performance to resist the passage of smoke. Joints and connections shall be smoke tight.

910.3.4.2 Location and Depth. The location and minimum depth of draft curtains shall be in accordance with Table 910.3.

910.4 Mechanical Smoke Exhaust. Engineered mechanical smoke exhaust shall be an acceptable alternate to smoke and heat vents.

910.4.1 Location. Exhaust fans shall be uniformly spaced within each draft-curtained area and the maximum distance between fans shall not be greater than 100 feet (30 480 mm).

910.4.2 Size. Fans shall have a maximum individual capacity of 30,000 cfm (14.2 m^3/s). The aggregate capacity of smoke exhaust fans shall be determined by the equation:

Equation 9-10

$$C = A \times 300$$

where:

C= Capacity of mechanical ventilation required, in cubic feet per minute (m^3/s).

A= Area of roof vents provided in square feet (m^2) in accordance with Table 910.3.

910.4.3 Operation. Mechanical smoke exhaust fans shall be automatically activated by the automatic sprinkler system or by heat detectors having operating characteristics equivalent to those described in 780 CMR 910.3.1. Individual manual controls of each fan unit shall also be provided.

910.4.4 Wiring and Control. Wiring for operation and control of smoke exhaust fans shall be connected ahead of the main disconnect and protected against exposure to temperatures in excess of 1,000°F (538°C) for a period of not less than 15 minutes. Controls shall be located so as to be immediately accessible to the fire service from the exterior of the building and protected against interior fire exposure by fire barriers having a fire-resistance rating not less than 1 hour.

910.4.5 Supply Air. Supply air for exhaust fans shall be provided at or near the floor level and shall be sized to provide a minimum of 50% of required exhaust. Openings for supply air shall be uniformly distributed around the periphery of the area served.

910.4.6 Interlocks. In combination comfort air-handling/smoke removal systems or independent comfort air-handling systems, fans shall be controlled to shut down in accordance with the approved smoke control sequence.

780 CMR 911.0 FIRE COMMAND CENTER

911.1 Features. Where required by other sections of 780 CMR, a fire command center for fire department operations shall be provided. The location and accessibility of the fire command center shall be separated from the remainder of the building by not less than a 1-hour fire-resistance-rated fire barrier. The room shall be a minimum of 96 square feet (nine m^2) with a minimum dimension of eight feet (2438 mm). A layout of the fire command center and all features required by the section to be contained therein shall be submitted for approval prior to installation. The fire command center shall comply with *NFPA 72* and shall contain the following features.

1. The emergency voice/alarm communication system unit.
2. The fire department communications unit.
3. Fire detection and alarm system annunciator unit.
4. Annunciator unit visually indicating the location of the elevators and whether they are operational.
5. Status indicators and controls for air-handling systems.
6. The fire-fighter's control panel required by 780 CMR 909.16 for smoke control systems installed in the building.
7. Controls for unlocking stairway doors simultaneously.
8. Sprinkler valve and water-flow detector display panels.
9. Emergency and standby power status indicators.
10. A telephone for fire department use with controlled access to the public telephone system.
11. Fire pump status indicators.
12. Schematic building plans indicating the typical floor plan and detailing the building core, means of egress, fire protection systems, fire-fighting equipment and fire department access.
13. Worktable.
14. Generator supervision devices, manual start and transfer features.
15. Public address system, where specifically required by other sections of 780 CMR.

780 CMR 912.0 FIRE DEPARTMENT CONNECTIONS

912.1 Required. All required water fire-extinguishing systems, foam-water extinguishing systems, and *standpipe systems* shall be provided with a fire department connection in accordance with the applicable NFPA standards. Standpipes in buildings under construction or demolition shall conform to 780 CMR 3311.0 and NFPA 241 listed in 780 CMR 35.00.

Exceptions:

1. *Limited area sprinkler systems* supplied from the domestic water system.
2. An *automatic sprinkler system* with less than 20 *sprinklers*.

912.2 Connections: Fire department connections shall be arranged in such a manner that the attachment to any one water *sprinkler* connection will serve all sprinklers, and the attachment to any one standpipe connection will serve all *standpipes* within the building.

912.3 Location: Fire department connections shall be located in a location approved by the fire department. Such connections shall be located so that immediate access is provided to the fire department. Fire department connections shall not be obstructed by fences, brushes, trees, walls or any other similar object.

912.4 Height: Fire department connections shall not be less than 18 inches (457 mm) and not more than 42 inches (1067 mm) in elevation, measured from the ground level to the centerline of the inlets.

912.5 Projection: Where the fire department connection will otherwise project beyond the property line or into the *public way*, a flush-type fire department connection shall be provided.

912.6 Hose thread: Hose thread in the fire department connection shall be uniform with that used by the local fire department.

912.7 Fittings: Fire department inlet connections shall be fitted with check valves, ball drip valves and plugs with chains or frangible caps.

780 CMR 913.0 PRIVATE UNDERGROUND FIRE MAINS AND YARD HYDRANTS

913.1 Private Underground Fire Mains and Yard Hydrants. Fire hydrants and underground fire mains installed on private property shall be located and installed as approved by the head of the fire department. Hydrants shall conform to the standards of the administrative authority of the jurisdiction and the fire department. Hydrants shall not be installed on a water main less than six inches in diameter. Standards of construction shall be in accordance with NFPA 24 as listed in 780 CMR 35.00.

780 CMR 914.0 FIRE PUMPS

914.1 General. Where fire pumps are required to be installed as part of a required or non-required system(s), the fire pump(s) shall be designed and installed in accordance with 527 CMR 12.00 and NFPA 20 as listed in 780 CMR 35.00.

914.2 Rooms. : Fire pumps and all related equipment shall be located in a dedicated room meeting the physical and environmental features of NFPA 20 listed in 780 CMR 35.00, and enclosed with not less than two hours fire resistive construction. Fire pumps rooms shall have either direct access to the room from grade or access by a two hour rated passageway and shall be properly secured from unauthorized entry.

914.3 Emergency Power: All fire pumps shall be provided with emergency power when installed in the following types of buildings or use groups. Emergency power equipment installation shall conform to 527 CMR 12.00 and NFPA 20 as listed in 780 CMR 35.00.

1. High-rise buildings as defined by M.G.L. c. 148 § 26A and 780 CMR.
2. Buildings and structures of Use Group A, with a total occupant load of more than 300 occupants.
3. Buildings and structures of Use Group E, with a total occupant load of more than 300 occupants.
4. Buildings and structures of Use Group H.
5. Buildings and structures of Use Group I, having surgery or treatment areas.

780 CMR 915 CARBON MONOXIDE PROTECTION

915.1 General. Carbon monoxide protection shall be provided as required by 527 CMR 31.00 and 248 CMR as listed in 780 CMR 35.00. All CO detectors utilized in new construction shall be hard-wired, except wireless devices, and all CO detectors and CO detector systems, whether hard-wired or wireless, shall satisfy the requirements of NFPA-720.

NON-TEXT PAGE

780 CMR 10.00

MEANS OF EGRESS

780 CMR 1001.0 ADMINISTRATION

1001.1 General. Buildings or portions thereof shall be provided with a means of egress system as required by 780 CMR 10.00. The provisions of 780 CMR 10.00 shall control the design, construction and arrangement of means of egress components required to provide an approved means of egress from structures and portions thereof.

> *Note: also refer to 521 CMR (Architectural Access Rules and Regulations) which will/may have impact on ingress/egress design and construction.*

1001.2 Minimum Requirements. It shall be unlawful to alter a building or structure in a manner that will reduce the number of exits or the capacity of the means of egress to less than required by 780 CMR.

1001.3 Maintenance-general. Means of egress shall be maintained to assure that all required egress elements and all required lighting and signage conform to the applicable requirements of 780 CMR.

1001.3.1 Obstructions. It shall be unlawful to obstruct, or reduce in any manner, the clear width of any doorway, hallway, passageway or other means of egress required by the provisions of 780 CMR.

1001.3.2 Maintenance of Exterior Stairs and Fire Escapes. All exterior stairways and fire escapes shall be kept free of snow and ice. Exterior stairways and fire escapes constructed of materials requiring the application of weather protecting products, shall have these products applied in an approved manner and shall be applied as often as necessary to maintain the stairways and fire escapes in safe condition. Where corrodible structural parts of such stairways and fire escapes tie directly into the building structural system, all joints shall be sealed, as necessary, to prevent water from damaging or corroding structural elements.

1001.3.3 Testing and Certification. All exterior bridges, steel or wooden stairways, fire escapes and egress balconies shall be examined and/or tested, and certified for structural adequacy and safety every five years, by a Massachusetts registered professional engineer, or others qualified and acceptable to the building official; said engineer or others shall then submit an affidavit to the building official.

780 CMR 1002.0 DEFINITIONS

1002.1 Definitions. The following words and terms shall, for the purposes of 780 CMR 10.00 and as used elsewhere in 780 CMR, have the meanings shown in 780 CMR 1002.1.

ACCESSIBLE MEANS OF EGRESS. A continuous and unobstructed way of egress travel from any point in a building or facility that provides an accessible route to an area of refuge, a horizontal exit or a public way.

AISLE ACCESSWAY. That portion of an exit access that leads to an aisle.

ALTERNATING TREAD DEVICE. A device that has a series of steps between 50 and 70 degrees (0.87 and 1.22 rad) from horizontal, usually attached to a center support rail in an alternating manner so that the user does not have both feet on the same level at the same time.

AREA OF REFUGE. An area where persons unable to use stairways can remain temporarily to await instructions or assistance during emergency evacuation.

BLEACHERS. Tiered seating facilities.

COMMON PATH OF EGRESS TRAVEL. That portion of exit access which the occupants are required to traverse before two separate and distinct paths of egress travel to two exits are available. Paths that merge are common paths of travel. Common paths of egress travel shall be included within the permitted travel distance.

CORRIDOR. An enclosed exit access component that defines and provides a path of egress travel to an exit.

DOOR, BALANCED. A door equipped with double-pivoted hardware so designed as to cause a semi counterbalanced swing action when opening.

EGRESS COURT. A court or yard which provides access to a public way for one or more exits.

EMERGENCY ESCAPE AND RESCUE OPENING. An operable window, door or other similar device that provides for a means of escape and access for rescue in the event of an emergency.

EXIT. That portion of a means of egress system which is separated from other interior spaces of a building or structure by fire-resistance-rated construction and opening protectives as required to provide a protected path of egress travel between the exit access and the exit discharge. Exits include exterior exit doors at ground level, exit enclosures, exit passageways, exterior exit stairs, exterior exit ramps and horizontal exits.

EXIT, HORIZONTAL. A path of egress travel from one building to an area in another building on approximately the same level, or a path of egress travel through or around a wall or partition to an area on approximately the same level in the same building, which affords safety from fire and smoke from the area of incidence and areas communicating therewith.

EXIT ACCESS. That portion of a means of egress system that leads from any occupied portion of a building or structure to an exit.

EXIT DISCHARGE. That portion of a means of egress system between the termination of an exit and a public way.

EXIT DISCHARGE, LEVEL OF. The horizontal plane located at the point at which an exit terminates and an exit discharge begins.

EXIT ENCLOSURE. An exit component that is separated from other interior spaces of a building or structure by fire-resistance-rated construction and opening protectives, and provides for a protected path of egress travel in a vertical or horizontal direction to the exit discharge or the public way.

EXIT PASSAGEWAY. An exit component that is separated from all other interior spaces of a building or structure by fire-resistance-rated construction and opening protectives, and provides for a protected path of egress travel in a horizontal direction to the exit discharge or the public way.

FIRE EXIT HARDWARE. Panic hardware that is listed for use on fire door assemblies.

FLOOR AREA, GROSS. The floor area within the inside perimeter of the exterior walls of the building under consideration, exclusive of vent shafts and courts, without deduction for corridors, stairways, closets, the thickness of interior walls, columns or other features. The floor area of a building, or portion thereof, not provided with surrounding exterior walls shall be the usable area under the horizontal projection of the roof or floor above. The gross floor area shall not include shafts with no openings or interior courts.

FLOOR AREA, NET. The actual occupied area not including unoccupied accessory areas such as corridors, stairways, toilet rooms, mechanical rooms and closets.

FOLDING AND TELESCOPIC SEATING. Tiered seating facilities having an overall shape and size that are capable of being reduced for purposes of moving or storing.

GRANDSTAND. Tiered seating facilities.

GUARD. A building component or a system of building components located at or near the open sides of elevated walking surfaces that minimizes the possibility of a fall from the walking surface to a lower level.

HANDRAIL. A horizontal or sloping rail intended for grasping by the hand for guidance or support.

MEANS OF EGRESS. A continuous and unobstructed path of vertical and horizontal egress travel from any occupied portion of a building or structure to a public way. A means of egress consists of three separate and distinct parts: the exit access, the exit and the exit discharge.

NOSING. The leading edge of treads of stairs and of landings at the top of stairway flights.

OCCUPANT LOAD. The number of persons for which the means of egress of a building or portion thereof is designed.

PANIC HARDWARE. A door-latching assembly incorporating a device that releases the latch upon the application of a force in the direction of egress travel.

PUBLIC WAY. A street, alley or other parcel of land open to the outside air leading to a street, that has been deeded, dedicated or otherwise permanently appropriated to the public for public use and which has a clear width and height of not less than ten feet (3048 mm).

RAMP. A walking surface that has a running slope steeper than one unit vertical in 20 units horizontal (5% slope).

SCISSOR STAIR. Two interlocking stairways providing two separate paths of egress located within one stairwell enclosure.

SMOKE-PROTECTED ASSEMBLY SEATING. Seating served by means of egress that is not subject to smoke accumulation within or under a structure.

STAIR. A change in elevation, consisting of one or more risers.

STAIRWAY. One or more flights of stairs, either exterior or interior, with the necessary landings and platforms connecting them, to form a continuous and uninterrupted passage from one level to another.

STAIRWAY, EXTERIOR. A stairway that is open on at least one side, except for required structural columns, beams, handrails and guards. The adjoining open areas shall be either yards, courts or public ways. The other sides of the exterior stairway need not be open.

STAIRWAY, INTERIOR. A stairway not meeting the definition of an exterior stairway.

STAIRWAY, SPIRAL. A stairway having a closed circular form in its plan view with uniform section-shaped treads attached to and radiating from a minimum-diameter supporting column.

WINDER. A tread with nonparallel edges.

780 CMR 1003.0 GENERAL MEANS OF EGRESS

1003.1 Applicability. The general requirements specified in 780 CMR 1003.0 through 1012.0 shall apply to all three elements of the means of egress system, in addition to those specific requirements for the exit access, the exit and the exit discharge detailed elsewhere in 780 CMR 10.00.

1003.2 Ceiling height. The means of egress shall have a ceiling height of not less than seven feet (2134 mm).

Exceptions:

1. Sloped ceilings in accordance with 780 CMR 1208.2.
2. Ceilings of dwelling units and sleeping units within residential occupancies in accordance with 780 CMR 1208.2.
3. Allowable projections in accordance with 780 CMR 1003.3.
4. Stair headroom in accordance with 780 CMR 1009.2.
5. Door height in accordance with 780 CMR 1008.1.1.

1003.3 Protruding Objects. Protruding objects shall comply with the requirements of 780 CMR 1003.3.1 through 1003.3.4.

1003.3.1 Headroom. Protruding objects are permitted to extend below the minimum ceiling height required by 780 CMR 1003.2 provided a minimum headroom of 80 inches (2032 mm) shall be provided for any walking surface, including walks, corridors, aisles and passageways. Not more than 50% of the ceiling area of a means of egress shall be reduced in height by protruding objects.

Exception: Door closers and stops shall not reduce headroom to less than 78 inches (1981 mm).

A barrier shall be provided where the vertical clearance is less than 80 inches (2032 mm) high. The leading edge of such a barrier shall be located 27 inches (686 mm) maximum above the floor.

1003.3.2 Free-standing Objects. A free-standing object mounted on a post or pylon shall not overhang that post or pylon more than 12 inches (305 mm) where the lowest point of the leading edge is more than 27 inches (686 mm) and less than 80 inches (2032 mm) above the walking surface. Where a sign or other obstruction is mounted between posts or pylons and the clear distance between the posts or pylons is greater than 12 inches (305 mm), the lowest edge of such sign or obstruction shall be 27 inches (685 mm) maximum or 80 inches (2030 mm) minimum above the finish floor or ground.

Exception. This requirement shall not apply to sloping portions of handrails serving stairs and ramps.

1003.3.3 Horizontal Projections. Structural elements, fixtures or furnishings shall not project horizontally from either side more than 4 inches (102 mm) over any walking surface between the heights of 27 inches (686 mm) and 80 inches (2032 mm) above the walking surface.

Exception: Handrails serving stairs and ramps are permitted to protrude 4.5 inches (114 mm) from the wall.

1003.3.4 Clear Width. Protruding objects shall not reduce the minimum clear width of accessible routes as required in 780 CMR 1104.

1003.4 Floor Surface. Walking surfaces of the means of egress shall have a slip-resistant surface and be securely attached.

1003.5 Elevation Change. Where changes in elevation of less than 12 inches (305 mm) exist in the means of egress, sloped surfaces shall be used. Where the slope is greater than one unit vertical in 20 units horizontal (5% slope), ramps complying with 780 CMR 1010.0 shall be used. Where the difference in elevation is six inches (152 mm) or less, the ramp shall be equipped with either handrails or floor finish materials that contrast with adjacent floor finish materials.

Exceptions:

1. A single step with a maximum riser height of seven inches (178 mm) is permitted for buildings with occupancies in Groups F, H, R-2 and R-3 as applicable in 780 CMR 101.2, and Groups S and U at exterior doors not required to be accessible by 780 CMR 11.00.
2. A stair with a single riser or with two risers and a tread is permitted at locations not required to be accessible by 780 CMR 11.00, provided that the risers and treads comply with 780 CMR 1009.3, the minimum depth of the tread is 13 inches (330 mm) and at least one handrail complying with 780 CMR 1009.11 is provided within 30 inches (762 mm) of the centerline of the normal path of egress travel on the stair.
3. An aisle serving seating that has a difference in elevation less than 12 inches (305 mm) is permitted at locations not required to be accessible by 780 CMR 11, provided that the risers and treads comply with 780 CMR 1024.11 and the aisle is provided with a handrail complying with 780 CMR 1024.13.

Any change in elevation in a corridor serving non ambulatory persons in a Group I-2 occupancy shall be by means of a ramp or sloped walkway.

1003.6 Means of Egress Continuity. The path of egress travel along a means of egress shall not be interrupted by any building element other than a means of egress component as specified in 780 CMR

10.00. Obstructions shall not be placed in the required width of a means of egress except projections permitted by 780 CMR 10.00. The required capacity of a means of egress system shall not be diminished along the path of egress travel.

1003.7 Elevators, Escalators and Moving Walks. Elevators, escalators and moving walks shall not be used as a component of a required means of egress from any other part of the building.

Exception. Elevators used as an accessible means of egress in accordance with 780 CMR 1007.4.

780 CMR 1004.0 OCCUPANT LOAD

1004.1 Design Occupant Load. In determining means of egress requirements, the number of occupants for whom means of egress facilities shall be provided shall be established by the largest number computed in accordance with 780 CMR 1004.1.1 through 1004.1.3.

Exception. *For A-2nc uses also note the prescriptive egress requirements of 780 CMR 1024.0 and 780 CMR 3403.0.*

1004.1.1 Actual Number. The actual number of occupants for whom each occupied space, floor or building is designed.

1004.1.2 Number by Table 1004.1.2. The number of occupants computed at the rate of one occupant per unit of area as prescribed in Table 1004.1.2.

TABLE 1004.1.2 MAXIMUM FLOOR AREA ALLOWANCES PER OCCUPANT

OCCUPANCY	FLOOR AREA IN SQ. FT. PER OCCUPANT
Agricultural building	300 gross
Aircraft hangars	500 gross
Airport terminal	
Baggage claim	20 gross
Baggage handling	300 gross
Concourse	100 gross
Waiting areas	15 gross
Assembly Gaming floors (keno, slots, etc.)	11 gross
Assembly with fixed seats	See 780 CMR 1003.2.2.9
Assembly without fixed seats	
Concentrated (chairs only—not fixed)	7 net
Standing space	5 net
Unconcentrated (tables and chairs)	15 net
For A-2nc uses also note the prescriptive egress requirements of 780 CMR 1024 and 780 CMR 3400.3.	
Bowling centers, allow five persons for each lane including 15 feet of runway, and for additional areas	7 net
Business areas	100 gross
Courtrooms - other than fixed seating areas	40 net
Dormitories	50 gross
Educational	
Classroom area	20 net
Shops and other vocational room areas	50 net
Exercise rooms	50 gross
H-5 Fabrication and manufacturing areas	200 gross
Industrial areas	100 gross
Institutional areas	
Inpatient treatment areas	240 gross
Outpatient areas	100 gross
Sleeping areas	120 gross
Kitchens, commercial	200 gross
Library	
Reading rooms	50 net
Stack area	100 gross
Locker rooms	50 gross
Mercantile	
Areas on other floors	60 gross
Basement and grade floor areas	30 gross
Storage, stock, shipping areas	300 gross
Parking garages	200 gross
Residential	200 gross
Skating rinks, swimming pools	
Rink and pool	50 gross
Decks	15 gross
Stages and platforms	15 net
Accessory storage areas, mechanical equipment room	300 gross
Warehouses	500 gross

For SI: 1 square foot - 0.0929 m^2

1004.1.3 Number by Combination. Where occupants from accessory spaces egress through a primary area, the calculated occupant load for the primary space shall include the total occupant load of the primary space plus the number of occupants egressing through it from the accessory space.

1004.2 Increased Occupant Load. The occupant load permitted in any building or portion thereof is permitted to be increased from that number established for the occupancies in Table 1004.1.2 provided that all other requirements of the code are also met based on such modified number and the occupant load shall not exceed one occupant per 5 square feet (0.47 m^2) of occupiable floor space. Where required by the building official, an approved aisle, seating or fixed equipment diagram substantiating any increase in occupant load shall be submitted. Where required by the building official, such diagram shall be posted.

1004.3 Posting of Occupant Load. Every room or space that is an assembly occupancy shall have the occupant load of the room or space posted in a conspicuous place, near the main exit or exit access doorway from the room or space. Posted signs shall be of an approved legible permanent design and shall be maintained by the owner or authorized agent.

1004.4 Exiting from Multiple Levels. Where exits serve more than one floor, only the occupant load of each floor considered individually shall be used in computing the required capacity of the exits at that floor, provided that the exit capacity shall not decrease in the direction of egress travel.

1004.5 Egress Convergence. Where means of egress from floors above and below converge at an intermediate level, the capacity of the means of egress from the point of convergence shall not be less than the sum of the two floors.

1004.6 Mezzanine Levels. The occupant load of a mezzanine level with egress onto a room or area below shall be added to that room or area's occupant load, and the capacity of the exits shall be designed for the total occupant load thus established.

1004.7 Fixed Seating. For areas having fixed seats and aisles, the occupant load shall be determined by the number of fixed seats installed therein.

For areas having fixed seating without dividing arms, the occupant load shall not be less than the number of seats based on one person for each 18 inches (457 mm) of seating length.

The occupant load of seating booths shall be based on one person for each 24 inches (610 mm) of booth seat length measured at the backrest of the seating booth.

1004.8 Outdoor Areas. Yards, patios, courts and similar outdoor areas accessible to and usable by the building occupants shall be provided with means of egress as required by 780 CMR 10.00. The occupant load of such outdoor areas shall be assigned by the building official in accordance with the anticipated use. Where outdoor areas are to be used by persons in addition to the occupants of the building, and the path of egress travel from the outdoor areas passes through the building, means of egress requirements for the building shall be based on the sum of the occupant loads of the building plus the outdoor areas.

Exceptions:

1. Outdoor areas used exclusively for service of the building need only have one means of egress.
2. Both outdoor areas associated with Group R-3 and individual dwelling units of Group R-2, as applicable in 780 CMR 101.2.

1004.9 Multiple Occupancies. Where a building contains two or more occupancies, the means of egress requirements shall apply to each portion of the building based on the occupancy of that space. Where two or more occupancies utilize portions of the same means of egress system, those egress components shall meet the more stringent requirements of all occupancies that are served.

780 CMR 1005.0 EGRESS WIDTH

1005.1 Minimum Required Egress Width. The means of egress width shall not be less than required by 780 CMR 1005.0. The total width of means of egress in inches (mm) shall not be less than the total occupant load served by the means of egress multiplied by the factors in Table 1005.1 and not less than specified elsewhere in 780 CMR. Multiple means of egress shall be sized such that the loss of any one means of egress shall not reduce the available capacity to less than 50% of the required capacity. The maximum capacity required from any story of a building shall be maintained to the termination of the means of egress.

Exception. Means of egress complying with 780 CMR 1024.8.

TABLE 1005.1 EGRESS WIDTH PER OCCUPANT SERVED

	WITHOUT SPRINKLER SYSTEM		WITH SPRINKLER SYSTEM[a]	
OCCUPANCY	Stairways (inches per occupant)	Other egress components (inches per occupant)	Stairways (inches per occupant)	Other egress components (inches per occupant)
Occupancies other than those listed below	0.3	0.2	0.2	0.15
Hazardous: H-1, H-2, H-3 & H-4	0.7	0. 4	0.3	0.2
Institutional: I-2	NA	NA	0.3	0.2

For SI: 1 inch = 25.4 mm. NA = Not applicable.

a. Buildings equipped throughout with an automatic sprinkler system in accordance with 780 CMR 903.3.1.1 or 903.3.1.2.

1005.2 Door Encroachment. Doors opening into the path of egress travel shall not reduce the required width to less than one-half during the course of the swing. When fully open, the door shall not project more than seven inches (178 mm) into the required width.

Exception: The restrictions on a door swing shall not apply to doors within individual dwelling units and sleeping units of Group R-2 and dwelling units of Group R-3.

780 CMR 1006.0 MEANS OF EGRESS ILLUMINATION

1006.1 Illumination Required. The means of egress, including the exit discharge, shall be illuminated at all times the building space served by the means of egress is occupied.

Exceptions:

1. Occupancies in Group U.
2. Aisle accessways in Group A.
3. Dwelling units and sleeping units in Groups R-1, R-2 and R-3.
4. Sleeping units of Group I occupancies.

1006.2 Illumination Level. The means of egress illumination level shall not be less than one foot-candle (11 lux) at the floor level.

Exception: For auditoriums, theaters, concert or opera halls and similar assembly occupancies, the illumination at the floor level is permitted to be reduced during performances to not less than 0.2 foot-candle (2.15 lux) provided that the required illumination is automatically restored upon activation of a premise's fire alarm system where such system is provided.

1006.3 Illumination Emergency Power. The power supply for means of egress illumination shall normally be provided by the premise's electrical supply.

In the event of power supply failure, an emergency electrical system shall automatically illuminate the following areas:

1. Exit access corridors, passageways and aisles in rooms and spaces which require two or more means of egress.
2. Exit access corridors and exit stairways located in buildings required to have two or more exits.
3. Exterior egress components at other than the level of exit discharge until exit discharge is accomplished for buildings required to have two or more exits.
4. Interior exit discharge elements, as permitted in 780 CMR 1023.1, in buildings required to have two or more exits.
5. The portion of the exterior exit discharge immediately adjacent to exit discharge doorways in buildings required to have two or more exits.

The emergency power system shall provide power for a duration of not less than 90 minutes and shall consist of storage batteries, unit equipment or an on-site generator. The installation of the emergency power system shall be in accordance with 780 CMR 2702.0.

1006.4 Performance of System. Emergency lighting facilities shall be arranged to provide initial illumination that is at least an average of one foot-candle (11 lux) and a minimum at any point of 0.1 foot-candle (1 lux) measured along the path of egress at floor level. Illumination levels shall be permitted to decline to 0.6 foot-candle (six lux) average and a minimum at any point of 0.06 foot-candle (0.6 lux) at the end of the emergency lighting time duration. A maximum-to-minimum illumination uniformity ratio of 40 to one shall not be exceeded.

780 CMR 1007.0 ACCESSIBLE MEANS OF EGRESS

1007.1 Accessible Means of Egress Required. Accessible means of egress shall comply with 780 CMR 1007.0. Accessible spaces shall be provided with not less than one accessible means of egress. Where more than one means of egress is required by 780 CMR 1014.1 or 1018.1 from any accessible space, each accessible portion of the space shall be served by not less than two accessible means of egress.

Exceptions:

1. Accessible means of egress are not required in alterations to existing buildings.
2. One accessible means of egress is required from an accessible mezzanine level in accordance with 780 CMR 1007.3 or 1007.4.
3. In assembly spaces with sloped floors, one accessible means of egress is required from a space where the common path of travel of the accessible route for access to the wheelchair spaces meets the requirements in 780 CMR 1024.8.

1007.2 Continuity and Components. Each required accessible means of egress shall be continuous to a public way and shall consist of one or more of the following components:

1. Accessible routes complying with 780 CMR 1104.
2. Stairways within exit enclosures complying with 780 CMR 1007.3 and 1019.1.
3. Elevators complying with 780 CMR 1007.4.
4. Platform lifts complying with 780 CMR 1007.5.
5. Horizontal exits.
6. Smoke barriers.

Exceptions:

1. Where the exit discharge is not accessible, an exterior area for assisted rescue must be provided in accordance with 780 CMR 1007.8.
2. Where the exit stairway is open to the exterior, the accessible means of egress shall include either an area of refuge in accordance with 780 CMR 1007.6 or an exterior area for assisted rescue in accordance with 780 CMR 1007.8.

1007.2.1 Buildings with Four or More Stories. In buildings where a required accessible floor is four or more stories above or below a level of exit discharge, at least one required accessible means of egress shall be an elevator complying with 780 CMR 1007.4.

Exceptions:

1. In buildings equipped throughout with an automatic sprinkler system installed in accordance with 780 CMR 903.3.1.1 or 903.3.1.2, the elevator shall not be required on floors provided with a horizontal exit and located at or above the level of exit discharge.
2. In buildings equipped throughout with an automatic sprinkler system installed in accordance with 780 CMR 903.3.1.1 or 903.3.1.2, the elevator shall not be required on floors provided with a ramp conforming to the provisions of 780 CMR 1010.0.

1007.3 Enclosed Exit Stairways. An enclosed exit stairway, to be considered part of an accessible means of egress, shall have a clear width of 48 inches (1219 mm) minimum between handrails and shall either incorporate an area of refuge within an enlarged floor-level landing or shall be accessed from either an area of refuge complying with 780 CMR 1007.6 or a horizontal exit.

Exceptions:

1. Open exit stairways as permitted by 780 CMR 1019.1 are permitted to be considered part of an accessible means of egress.
2. The area of refuge is not required at open stairways that are permitted by 780 CMR 1019.1 in buildings or facilities that are equipped throughout with an automatic sprinkler system installed in accordance with 780 CMR 903.3.1.1.
3. The clear width of 48 inches (1219 mm) between handrails and the area of refuge is not required at exit stairways in buildings or facilities equipped throughout with an automatic sprinkler system installed in accordance with 780 CMR 903.3.1.1 or 903.3.1.2.
4. The clear width of 48 inches (1219 mm) between handrails is not required for enclosed exit stairways accessed from a horizontal exit.
5. Areas of refuge are not required at exit stairways serving open parking garages.

1007.4 Elevators. An elevator to be considered part of an accessible means of egress shall comply with the emergency operation and signaling device requirements of 524 CMR (also see Section 2.27 of ASME A17.1). Standby power shall be provided in accordance with 524 CMR (also see 780 CMR 2702.0). The elevator shall be accessed from either an area of refuge complying with 780 CMR 1007.6 or a horizontal exit.

Exceptions:

1. Elevators are not required to be accessed from an area of refuge or horizontal exit in open parking garages ***unless otherwise required by 521 CMR***.
2. Elevators are not required to be accessed from an area of refuge or horizontal exit in buildings and facilities equipped throughout with an automatic sprinkler system installed in accordance with 780 CMR 903.3.1.1 or 903.3.1.2 ***unless otherwise required by 521 CMR***.

1007.5 Platform Lifts. Platform (wheelchair) lifts shall not serve as part of an accessible means of egress, except where allowed as part of a required accessible route per ***521 CMR***. Platform lifts in accordance with 780 CMR 2702 shall be installed in accordance with ***524 CMR***. Standby power shall be provided for platform lifts permitted to serve as part of a means of egress.

1007.6 Areas of Refuge. Every required area of refuge shall be accessible from the space it serves by an accessible means of egress. The maximum travel distance from any accessible space to an area of refuge shall not exceed the travel distance permitted for the occupancy in accordance with 780 CMR 1015.1. Every required area of refuge shall have direct access to an enclosed stairway complying with 780 CMR 1007.3 and 1019.1 or an elevator complying with 780 CMR 1007.4. Where an elevator lobby is used as an area of refuge, the shaft and lobby shall comply with 780 CMR 1019.1.8 for smokeproof enclosures except where the elevators are in an area of refuge formed by a horizontal exit or smoke barrier.

1007.6.1 Size. Each area of refuge shall be sized to accommodate one wheelchair space of 30 inches by 48 inches (762 mm by1219 mm) for each 200 occupants or portion thereof, based on the occupant load of the area of refuge and areas served by the area of refuge. Such wheelchair spaces shall not reduce the required means of egress width. Access to any of the required wheelchair spaces in an area of refuge shall not be obstructed by more than one adjoining wheelchair space.

1007.6.2 Separation. Each area of refuge shall be separated from the remainder of the story by a smoke barrier complying with 780 CMR 709. Each area of refuge shall be designed to minimize the intrusion of smoke.

Exceptions:

1. Areas of refuge located within a stairway enclosure.
2. Areas of refuge where the area of refuge and areas served by the area of refuge are equipped throughout with an automatic sprinkler system installed in accordance with 780 CMR 903.3.1.1 or 903.3.1.2.

1007.6.3 Two-way Communication. Areas of refuge shall be provided with a two-way communication system between the area of refuge and a central control point. If the central control point is not constantly attended, the area of refuge shall also have controlled access to a public telephone system. Location of the central control point shall be approved by the fire department. The two-way communication system shall include both audible and visible signals.

1007.6.4 Instructions. In areas of refuge that have a two-way emergency communications system, instructions on the use of the area under emergency conditions shall be posted adjoining the communications system. The instructions shall include all of the following:

1. Directions to find other means of egress.
2. Persons able to use the exit stairway do so as soon as possible, unless they are assisting others.
3. Information on planned availability of assistance in the use of stairs or supervised operation of elevators and how to summon such assistance.
4. Directions for use of the emergency communications system.

1007.6.5 Identification. Each door providing access to an area of refuge (area of rescue assistance) from an adjacent floor area shall be identified by a sign complying with ***521 CMR***. Where exit sign illumination is required by

780 CMR 1011.2, the area of refuge sign shall be illuminated. Additionally, tactile signage complying with ***521 CMR*** shall be located at each door to an area of refuge.

1007.7 Signage. At exits and elevators serving a required accessible space but not providing an approved accessible means of egress, signage shall be installed indicating the location of accessible means of egress.

1007.8 Exterior Area for Assisted Rescue. The exterior area for assisted rescue must be open to the outside air and meet the requirements of 780 CMR 1007.6.1. Separation walls shall comply with the requirements of 780 CMR 704.0 for exterior walls. Where walls or openings are between the area for assisted rescue and the interior of the building, the building exterior walls within ten feet (3048 mm) horizontally of a nonrated wall or unprotected opening shall be constructed as required for a minimum one-hour fire-resistance rating with ¾-hour opening protectives. This construction shall extend vertically from the ground to a point ten feet (3048 mm) above the floor level of the area for assisted rescue or to the roof line, whichever is lower.

1007.8.1 Openness. The exterior area for assisted rescue shall be at least 50% open, and the open area above the guards shall be so distributed as to minimize the accumulation of smoke or toxic gases.

1007.8.2 Exterior Exit Stairway. Exterior exit stairways that are part of the means of egress for the exterior area for assisted rescue shall provide a clear width of 48 inches (1219 mm) between handrails.

1007.8.3 Identification. Exterior areas for assisted rescue shall have identification as required for area of refuge that complies with 780 CMR 1007.6.5.

780 CMR 1008 DOORS, GATES AND TURNSTILES

1008.1 Doors. Means of egress doors shall meet the requirements of 780 CMR 1008.0. Doors serving a means of egress system shall meet the requirements of 780 CMR 1008.0 and 780 CMR 1017.2. Doors provided for egress purposes in numbers greater than required by 780 CMR shall meet the requirements of 780 CMR 1008.0.

Means of egress doors shall be readily distinguishable from the adjacent construction and finishes such that the doors are easily recognizable as doors. Mirrors or similar reflecting materials shall not be used on means of egress doors. Means of egress doors shall not be concealed by curtains, drapes, decorations or similar materials.

1008.1.1 Size of Doors. For A-2 nightclubs (A-2nc) also see 780 CMR 1024, otherwise, the minimum width of each door opening shall be sufficient for the occupant load thereof and shall provide a clear width of not less than 32 inches (813 mm). Clear openings of doorways with swinging doors shall be measured between the face of the door and the stop, with the door open 90 degrees (1.57 rad). Where 780 CMR 1008.1 requires a minimum clear width of 32 inches (813 mm) and a door opening includes two door leaves without a mullion, one leaf shall provide a clear opening width of 32 inches (813 mm). The maximum width of a swinging door leaf shall be 48 inches (1219 mm) nominal. Means of egress doors in an occupancy in Group I-2 used for the movement of beds shall provide a clear width not less than 41½ inches (1054 mm). The height of doors shall not be less than 80 inches (2032 mm).

Exceptions:

1. The minimum and maximum width shall not apply to door openings that are not part of the required means of egress in occupancies in Groups R-2 and R-3 as applicable in 780 CMR 101.2.
2. Door openings to resident sleeping units in occupancies in Group I-3 shall have a clear width of not less than 28 inches (711 mm).
3. Door openings to storage closets less than ten square feet (0.93 m^2) in area shall not be limited by the minimum width.
4. Width of door leafs in revolving doors that comply with 780 CMR 1008.1.3.1 shall not be limited.
5. Door openings within a dwelling unit or sleeping unit shall not be less than 78 inches (1981 mm) in height.
6. Exterior door openings in dwelling units and sleeping units, other than the required exit door, shall not be less than 76 inches (1930 mm) in height.
7. Interior egress doors within a dwelling unit or sleeping unit which is not required to be adaptable or accessible.
8. Door openings required to be accessible within Type B dwelling units shall have a minimum clear width of 31¾ inches (806 mm).

1008.1.1.1 Projections into Clear Width. There shall not be projections into the required clear width lower than 34 inches (864 mm) above the floor or ground. Projections into the clear opening width between 34 inches (864 mm) and 80 inches (2032 mm) above the floor or ground shall not exceed four inches (102 mm).

1008.1.2 Door Swing. Egress doors shall be side-hinged swinging.

Exceptions:

1. Private garages, office areas, factory and storage areas with an occupant load of ten or less.

2. Group I-3 occupancies used as a place of detention.
3. Doors within or serving a single dwelling unit in Groups R-2 and R-3 as applicable in 780 CMR 101.2.
4. In other than Group H occupancies, revolving doors complying with 780 CMR 1008.1.3.1.
5. In other than Group H occupancies, horizontal sliding doors complying with 780 CMR 1008.1.3.3 are permitted in a means of egress.
6. Power-operated doors in accordance with 780 CMR 1008.1.3.2.

Doors shall swing in the direction of egress travel where serving an occupant load of 50 or more persons or a Group H occupancy.

The opening force for interior side-swinging doors without closers shall not exceed a five-pound (22 N) force. For other side-swinging, sliding and folding doors, the door latch shall release when subjected to a 15-pound (67 N) force. The door shall be set in motion when subjected to a 30-pound (133 N) force. The door shall swing to a full-open position when subjected to a 15-pound (67 N) force. Forces shall be applied to the latch side.

1008.1.3 Special Doors. Special doors and security grilles shall comply with the requirements of 780 CMR 1008.1.3.1 through 1008.1.3.5.

1008.1.3.1 Revolving Doors. Revolving doors shall comply with the following:

1. Each revolving door shall be capable of collapsing into a bookfold position with parallel egress paths providing an aggregate width of 36 inches (914 mm).
2. A revolving door shall not be located within ten feet (3048 mm) of the foot of or top of stairs or escalators. A dispersal area shall be provided between the stairs or escalators and the revolving doors.
3. The revolutions per minute (rpm) for a revolving door shall not exceed those shown in Table 1008.1.3.1.
4. Each revolving door shall have a side-hinged swinging door which complies with 780 CMR 1008.1 in the same wall and within ten feet (3048 mm) of the revolving door.

1008.1.3.1.1 Egress Component. A revolving door used as a component of a means of egress shall comply with 780 CMR 1008.1.3.1 and the following three conditions:

1. Revolving doors shall not be given credit for more than 50% of the required egress capacity.
2. Each revolving door shall be credited with no more than a 50-person capacity.
3. Each revolving door shall be capable of being collapsed when a force of not more than 130 pounds (578 N) is applied within three inches (76 mm) of the outer edge of a wing.

TABLE 1008.1.3.1 REVOLVING DOOR SPEEDS

INSIDE DIAMETER (feet-inches)	POWER-DRIVEN-TYPE SPEED CONTROL (rpm)	MANUAL-TYPE SPEED CONTROL (rpm)
6-6	11	12
7-0	10	11
7-6	9	11
8-0	9	10
8-6	8	9
9-0	8	9
9-6	7	8
10-0	7	8

For SI: 1 inch - 25.4 mm, 1 foot - 304.8 mm.

1008.1.3.1.2 Other than Egress Component. A revolving door used as other than a component of a means of egress shall comply with 780 CMR 1008.1.3.1. The collapsing force of a revolving door not used as a component of a means of egress shall not be more than 180 pounds (801 N).

Exception: A collapsing force in excess of 180 pounds (801 N) is permitted if the collapsing force is reduced to not more than 130 pounds (578 N) when at least one of the following conditions is satisfied:

1. There is a power failure or power is removed to the device holding the door wings in position.
2. There is an actuation of the automatic sprinkler system where such system is provided.
3. There is an actuation of a smoke detection system which is installed in accordance with 780 CMR 907.0 to provide coverage in areas within the building which are within 75 feet (22 860 mm) of the revolving doors.
4. There is an actuation of a manual control switch, in an approved location and clearly defined, which reduces the holding force to below the 130-pound (578 N) force level.

1008.1.3.2 Power-operated Doors. Where means of egress doors are operated by power, such as doors with a photoelectric-actuated mechanism to open the door upon the approach of a person, or doors with power-assisted manual operation, the design shall be such that in the event of power failure, the door is capable of being opened manually to permit means of egress travel or closed where necessary to safeguard means of egress. The forces required to open these doors manually shall not exceed those specified in 780 CMR 1008.1.2, except that the force to set the door in motion shall not exceed 50 pounds (220 N). The door shall be capable of swinging from any position to the full width of the opening in which such door is installed when a force is applied to the door on the side from which egress is made. Full-power-operated doors shall comply with *BHMA A156.10*. Power-assisted and low-energy doors shall comply with *BHMA A156.19*.

Exceptions:

1. Occupancies in Group I-3.
2. Horizontal sliding doors complying with 780 CMR 1008.1.3.3.
3. For a biparting door in the emergency breakout mode, a door leaf located within a multiple-leaf opening shall be exempt from the minimum 32-inch (813 mm) single-leaf requirement of 780 CMR 1008.1.1, provided a minimum 32-inch (813 mm) clear opening is provided when the two biparting leaves meeting in the center are broken out.

1008.1.3.3 Horizontal Sliding Doors. In other than Group H occupancies, horizontal sliding doors permitted to be a component of a means of egress in accordance with Exception 5 to 780 CMR 1008.1.2 shall comply with all of the following criteria:

1. The doors shall be power operated and shall be capable of being operated manually in the event of power failure.
2. The doors shall be openable by a simple method from both sides without special knowledge or effort.
3. The force required to operate the door shall not exceed 30 pounds (133 N) to set the door in motion and 15 pounds (67 N) to close the door or open it to the minimum required width.
4. The door shall be openable with a force not to exceed 15 pounds (67 N) when a force of 250 pounds (1100 N) is applied perpendicular to the door adjacent to the operating device.
5. The door assembly shall comply with the applicable fire protection rating and, where rated, shall be self-closing or automatic-closing by smoke detection, shall be installed in accordance with NFPA 80 and shall comply with 780 CMR 715.
6. The door assembly shall have an integrated standby power supply.
7. The door assembly power supply shall be electrically supervised.
8. The door shall open to the minimum required width within ten seconds after activation of the operating device.

1008.1.3.4 Access-controlled Egress Doors. The entrance doors in a means of egress in buildings with an occupancy in Group A, B, E, M, R-1 or R-2 and entrance doors to tenant spaces in occupancies in Groups A, B, E, M, R-1 and R-2 are permitted to be equipped with an approved entrance and egress access control system which shall be installed in accordance with all of the following criteria:

1. A sensor shall be provided on the egress side arranged to detect an occupant approaching the doors. The doors shall be arranged to unlock by a signal from or loss of power to the sensor.
2. Loss of power to that part of the access control system which locks the doors shall automatically unlock the doors.
3. The doors shall be arranged to unlock from a manual unlocking device located 40 inches to 48 inches (1016 mm to 1219 mm) vertically above the floor and within five feet (1524 mm) of the secured doors. Ready access shall be provided to the manual unlocking device and the device shall be clearly identified by a sign that reads "PUSH TO EXIT." When operated, the manual unlocking device shall result in direct interruption of power to the lock-independent of the access control system electronics- and the doors shall remain unlocked for a minimum of 30 seconds.
4. Activation of the building fire alarm system, if provided, shall automatically unlock the doors, and the doors shall remain unlocked until the fire alarm system has been reset.
5. Activation of the building automatic sprinkler or fire detection system, if provided, shall automatically unlock the doors. The doors shall remain unlocked until the fire alarm system has been reset.
6. Entrance doors in buildings with an occupancy in Group A, B, E or M shall not be secured from the egress side during periods that the building is open to the general public.

1008.1.3.5 Security Grilles. In Groups B, F, M and S, horizontal sliding or vertical security grilles are permitted at the main exit and shall be openable from the inside without the use of a key or special knowledge or effort during periods that the space is occupied. The grilles shall remain secured in the full-open position during the period of occupancy by the general public. Where two or more means of egress are required, not more than ½ of the exits or exit access doorways shall be equipped with horizontal sliding or vertical security grilles.

1008.1.4 Floor Elevation. There shall be a floor or landing on each side of a door. Such floor or landing shall be at the same elevation on each side of the door. Landings shall be level except for exterior landings, which are permitted to have a slope not to exceed 0.25 unit vertical in 12 units horizontal (2% slope).

Exceptions:

1. Doors serving individual dwelling units in Groups R-2 and R-3 as applicable in 780 CMR 101.2 where the following apply:
   1.1. A door is permitted to open at the top step of an interior flight of stairs, provided the door does not swing over the top step.
   1.2. Screen doors and storm doors are permitted to swing over stairs or landings.
2. Exterior doors as provided for in 780 CMR 1003.5, Exception 1, and 780 CMR 1017.2, which are not on an accessible route.
3. In Group R-3 occupancies, the landing at an exterior doorway shall not be more than 7¾ inches (197 mm) below the top of the threshold, provided the door, other than an exterior storm or screen door, does not swing over the landing.
4. Variations in elevation due to differences in finish materials, but not more than 0.5 inch (12.7 mm).
5. Exterior decks, patios or balconies that are part of Type B dwelling units and have impervious surfaces, and that are not more than 4 inches (102 mm) below the finished floor level of the adjacent interior space of the dwelling unit.

1008.1.5 Landings at Doors. Landings shall have a width not less than the width of the stairway or the door, whichever is the greater. Doors in the fully open position shall not reduce a required dimension by more than seven inches (178 mm). When a landing serves an occupant load of 50 or more, doors in any position shall not reduce the landing to less than ½ its required width. Landings shall have a length measured in the direction of travel of not less than 44 inches (1118 mm).

Exception. Landing length in the direction of travel in Group R-3 as applicable in 780 CMR 101.2 and Group U and within individual units of Group R-2 as applicable in 780 CMR 101.2 need not exceed 36 inches (914 mm).

1008.1.6 Thresholds. Thresholds at doorways shall not exceed 0.75 inch (19.1 mm) in height for sliding doors serving dwelling units or 0.5 inch (12.7 mm) for other doors. Raised thresholds and floor level changes greater than 0.25 inch (6.4 mm) at doorways shall be beveled with a slope not greater than one unit vertical in two units horizontal (50% slope).

Exception. The threshold height shall be limited to 7¾ inches (197 mm) where the occupancy is Group R-2 or R-3 as applicable in 780 CMR 101.2, the door is an exterior door that is not a component of the required means of egress and the doorway is not on an accessible route.

1008.1.7 Door Arrangement. Space between two doors in series shall be 48 inches (1219 mm) minimum plus the width of a door swinging into the space. Doors in series shall swing either in the same direction or away from the space between doors.

Exceptions:

1. The minimum distance between horizontal sliding power-operated doors in a series shall be 48 inches (1219 mm).
2. Storm and screen doors serving individual dwelling units in Groups R-2 and R-3 as applicable in 780 CMR 101.2 need not be spaced 48 inches (1219 mm) from the other door.
3. Doors within individual dwelling units in Groups R-2 and R-3 as applicable in 780 CMR 101.2 other than within Type A dwelling units.

1008.1.8 Door Operations. Except as specifically permitted by 780 CMR 1008.1 egress doors shall be readily openable from the egress side without the use of a key or special knowledge or effort.

1008.1.8.1 Hardware. Door handles, pulls, latches, locks and other operating devices on doors required to be accessible by 780 CMR 11 shall not require tight grasping, tight pinching or twisting of the wrist to operate.

1008.1.8.2 Hardware Height. Door handles, pulls, latches, locks and other operating devices shall be installed 34 inches (864 mm) minimum and 48 inches (1219 mm) maximum above the finished floor. Locks used only for security purposes and not used for normal operation are permitted at any height.

1008.1.8.3 Locks and Latches. Locks and latches shall be permitted to prevent operation of doors where any of the following exists:

1. Places of detention or restraint.
2. In buildings in occupancy Group A having an occupant load of 300 or less, Groups B, F, M and S, and in churches, the main exterior door or doors are permitted to be equipped with key-operated locking devices from the egress side provided:
   2.1. The locking device is readily distinguishable as locked,
   2.2. A readily visible durable sign is posted on the egress side on or adjacent to the door stating: THIS DOOR TO REMAIN UNLOCKED WHEN BUILDING IS OCCUPIED. The sign shall be in letters one inch (25 mm) high on a contrasting background,
   2.3. The use of the key-operated locking device is revocable by the building official for due cause.
3. Where egress doors are used in pairs, approved automatic flush bolts shall be

permitted to be used, provided that the door leaf having the automatic flush bolts has no doorknob or surface-mounted hardware.

4. Doors from individual dwelling or sleeping units of Group R occupancies having an occupant load of ten or less are permitted to be equipped with a night latch, dead bolt or security chain, provided such devices are openable from the inside without the use of a key or tool.

1008.1.8.4 Bolt Locks. Manually operated flush bolts or surface bolts are not permitted.

Exceptions:
1. On doors not required for egress in individual dwelling units or sleeping units.
2. Where a pair of doors serves a storage or equipment room, manually operated edge- or surface-mounted bolts are permitted on the inactive leaf.

1008.1.8.5 Unlatching. The unlatching of any leaf shall not require more than one operation.

Exception: More than one operation is permitted for unlatching doors in the following locations:
1. Places of detention or restraint.
2. Where manually operated bolt locks are permitted by 780 CMR 1008.1.8.4.
3. Doors with automatic flush bolts as permitted by 780 CMR 1008.1.8.3, Exception 3.
4. Doors from individual dwelling units and guestrooms of Group R occupancies as permitted by 780 CMR 1008.1.8.3, Exception 4.

1008.1.8.6 Delayed Egress Locks. Approved, listed, delayed egress locks shall be permitted to be installed on doors serving any occupancy except Group A, E and H occupancies in buildings that are equipped throughout with an automatic sprinkler system in accordance with 780 CMR 903.3.1.1 or an approved automatic smoke or heat detection system installed in accordance with 780 CMR 907.0, provided that the doors unlock in accordance with 780 CMR 1008.1.8.6 Items 1. through 6. A building occupant shall not be required to pass through more than one door equipped with a delayed egress lock before entering an exit.

1. The doors unlock upon actuation of the automatic sprinkler system or automatic fire detection system.
2. The doors unlock upon loss of power controlling the lock or lock mechanism.
3. The door locks shall have the capability of being unlocked by a signal from the fire command center.
4. The initiation of an irreversible process which will release the latch in not more than 15 seconds when a force of not more than 15 pounds (67 N) is applied for one second to the release device. Initiation of the irreversible process shall activate an audible signal in the vicinity of the door. Once the door lock has been released by the application of force to the releasing device, relocking shall be by manual means only.

   Exception. Where approved, a delay of not more than 30 seconds is permitted.

5. A sign shall be provided on the door located above and within 12 inches (305 mm) of the release device reading: PUSH UNTIL ALARM SOUNDS. DOOR CAN BE OPENED IN 15 [30] SECONDS.
6. Emergency lighting shall be provided at the door.
7. ***In Use Group B buildings where one tenant occupies the entire floor and the building has a security station staffed 24 hours each day, the installation of a door release device described in 780 CMR 1008.1.8.6, item 4, may be omitted on egress doors in elevator lobbies provided that all other items in 780 CMR 1008.1.8.6 are met, and in addition, the following items are met:***

a. The building is equipped throughout with both a supervised automatic fire sprinkler system and a supervised automatic fire alarm system.

b. The supervised automatic fire sprinkler system and the supervised fire alarm system shall interface with the access control system to unlock the doors automatically upon activation of either system.

c. The elevator lobby shall be equipped with a telephone connected directly to the staffed security station and a sign having block letters one inch in height shall be provided directly above the telephone and shall state: "In case of emergency, pick up telephone. You will be connected directly to security personnel".

1008.1.8.7 Stairway Doors. Interior stairway means of egress doors shall be openable from both sides without the use of a key or special knowledge or effort.

Exceptions.
1. Stairway discharge doors shall be openable from the egress side and shall only be locked from the opposite side.
2. 780 CMR 1008.1.8.7 shall not apply to doors arranged in accordance with 780 CMR 403.12.
3. In stairways serving not more than four stories, doors are permitted to be locked from the side opposite the egress side, provided they are openable from the egress side.

1008.1.8.8 Apartment Houses; Exterior Doors and Locks (M.G.L. c. 143, § 3R). ***In accordance with M.G.L. c. 143, § 3R, at least one of the doors of the main common entryway into every apartment house having more than three apartments shall be designed or equipped as to close automatically and lock automatically with a lock, including a lock with an electrically-operated striker mechanism, a self-closing door and associated equipment. Such associated equipment shall include an intercom system tied independently to each apartment and where from each apartment the electrically-operated striker mechanism can be released ; additionally, where the number of apartments in a given building, irrespective of fire/party wall separation, is ten or more apartments, a closed circuit security camera system shall also be incorporated in such manner that from each apartment, apartment occupants can utilize their personal television sets to observe who is seeking entrance to the building. The intercom and closed circuit security camera systems shall be designed and listed for the weather and temperature conditions to which they will be exposed.***

Exceptions: lodging houses defined in M.G.L. c. 140, § 22: dormitories of charitable, educational or philanthropic institutions; or projects of housing authorities, as defined in M.G.L. c. 121B.

1008.1.9 Panic and Fire Exit Hardware. Where panic and fire exit hardware is installed, it shall comply with the following:

1. The actuating portion of the releasing device shall extend at least one-half of the door leaf width.
2. A maximum unlatching force of 15 pounds (67 N).

Each door in a means of egress from an occupancy of Group A or E having an occupant load of 100 or more and any occupancy of Group H-1, H-2, H-3 or H-5 shall not be provided with a latch or lock unless it is panic hardware or fire exit hardware.

If balanced doors are used and panic hardware is required, the panic hardware shall be the push-pad type and the pad shall not extend more than one-half the width of the door measured from the latch side.

1008.2 Gates. Gates serving the means of egress system shall comply with the requirements of 780 CMR 1008.2. Gates used as a component in a means of egress shall conform to the applicable requirements for doors.

Exception. Horizontal sliding or swinging gates exceeding the four-foot (1219 mm) maximum leaf width limitation are permitted in fences and walls surrounding a stadium.

1008.2.1 Stadiums. Panic hardware is not required on gates surrounding stadiums where such gates are under constant immediate supervision while the public is present, and further provided that safe dispersal areas based on three square feet (0.28 m^2) per occupant are located between the fence and enclosed space. Such required safe dispersal areas shall not be located less than 50 feet (15 240 mm) from the enclosed space. See 780 CMR 1017 for means of egress from safe dispersal areas.

1008.3 Turnstiles. Turnstiles or similar devices that restrict travel to one direction shall not be placed so as to obstruct any required means of egress.

Exception. Each turnstile or similar device shall be credited with no more than a 50-person capacity where all of the following provisions are met:

1. Each device shall turn free in the direction of egress travel when primary power is lost, and upon the manual release by an employee in the area.
2. Such devices are not given credit for more than 50% of the required egress capacity.
3. Each device is not more than 39 inches (991 mm) high.
4. Each device has at least 16.5 inches (419 mm) clear width at and below a height of 39 inches (991 mm) and at least 22 inches (559 mm) clear width at heights above 39 inches (991 mm).

Where located as part of an accessible route, turnstiles shall have at least 36 inches (914 mm) clear at and below a height of 34 inches (864 mm), at least 32 inches (813 mm) clear width between 34 inches (864 mm) and 80 inches (2032 mm) and shall consist of a mechanism other than a revolving device.

1008.3.1 High Turnstile. Turnstiles more than 39 inches (991 mm) high shall meet the requirements for revolving doors.

1008.3.2 Additional Door. Where serving an occupant load greater than 300, each turnstile that is not portable shall have a side-hinged swinging door which conforms to 780 CMR 1008.1 within 50 feet (15 240 mm).

780 CMR 1009.0 STAIRWAYS AND HANDRAILS

1009.1 Stairway Width. *For A-2 nightclubs (A-2nc) also see 780 CMR 1024.0*, otherwise, the width of stairways shall be determined as specified in 780 CMR 1005.1, but such width shall not be less than 44 inches (1118 mm). See 780 CMR 1007.3 for accessible means of egress stairways.

Exceptions:

1. Stairways serving an occupant load of 50 or less shall have a width of not less than 36 inches

(914 mm).

2. Spiral stairways as provided for in 780 CMR 1009.9.
3. Aisle stairs complying with 780 CMR 1024.
4. Where a stairway lift is installed on stairways serving occupancies in Group R-3, or within dwelling units in occupancies in Group R-2, both as applicable in 780 CMR 101.2, a clear passage width not less than 20 inches (508 mm) shall be provided. If the seat and platform can be folded when not in use, the distance shall be measured from the folded position.

1009.2 Headroom. Stairways shall have a minimum headroom clearance of 80 inches (2032 mm) measured vertically from a line connecting the edge of the nosings. Such headroom shall be continuous above the stairway to the point where the line intersects the landing below, one tread depth beyond the bottom riser. The minimum clearance shall be maintained the full width of the stairway and landing.

Exception. Spiral stairways complying with 780 CMR 1009.9 are permitted a 78-inch (1981 mm) headroom clearance.

1009.3 Stair Treads and Risers. Stair riser heights shall be seven inches (178 mm) maximum and four inches (102 mm) minimum. Stair tread depths shall be 11 inches (279 mm) minimum. The riser height shall be measured vertically between the leading edges of adjacent treads. The greatest riser height within any flight of stairs shall not exceed the smallest by more than 0.375 inch (9.5 mm). The tread depth shall be measured horizontally between the vertical planes of the foremost projection of adjacent treads and at right angle to the tread's leading edge. The greatest tread depth within any flight of stairs shall not exceed the smallest by more than 0.375 inch (9.5 mm). Winder treads shall have a minimum tread depth of 11 inches (279 mm) measured at a right angle to the tread's leading edge at a point 12 inches (305 mm) from the side where the treads are narrower and a minimum tread depth of ten inches (254 mm). The greatest winder tread depth at the 12-inch (305 mm) walk line within any flight of stairs shall not exceed the smallest by more than 0.375 inch (9.5 mm).

Exceptions:

1. Circular stairways in accordance with 780 CMR 1009.7.
2. Winders in accordance with 780 CMR 1009.8.
3. Spiral stairways in accordance with 780 CMR 1009.9.
4. Aisle stairs in assembly seating areas where the stair pitch or slope is set, for sightline reasons, by the slope of the adjacent seating area in accordance with 780 CMR 1024.11.2.
5. In occupancies in Group R-3, as applicable in 780 CMR 101.2, within dwelling units in occupancies in Group R-2, as applicable in 780 CMR 101.2, and in occupancies in Group U, which are accessory to an occupancy in Group R-3, as applicable in 780 CMR 101.2, the maximum riser height shall be 7.75 inches (197 mm) and the minimum tread depth shall be ten inches (254 mm), the minimum winder tread depth at the walk line shall be ten inches (254 mm), and the minimum winder tread depth shall be six inches (152 mm). A nosing not less than 0.75 inch (19.1 mm) but not more than 1.25 inches (32 mm) shall be provided on stairways with solid risers where the tread depth is less than 11 inches (279 mm).
6. See 780 CMR 34.00 for the replacement of existing stairways.

1009.3.1 Dimensional Uniformity. Stair treads and risers shall be of uniform size and shape. The tolerance between the largest and smallest riser or between the largest and smallest tread shall not exceed 0.375 inch (9.5 mm) in any flight of stairs.

Exceptions:

1. Nonuniform riser dimensions of aisle stairs complying with 780 CMR 1024.11.2.
2. Consistently shaped winders, complying with 780 CMR 1009.8, differing from rectangular treads in the same stairway flight.

Where the bottom or top riser adjoins a sloping public way, walkway or driveway having an established grade and serving as a landing, the bottom or top riser is permitted to be reduced along the slope to less than four inches (102 mm) in height with the variation in height of the bottom or top riser not to exceed one unit vertical in 12 units horizontal (8% slope) of stairway width. The nosings or leading edges of treads at such nonuniform height risers shall have a distinctive marking stripe, different from any other nosing marking provided on the stair flight. The distinctive marking stripe shall be visible in descent of the stair and shall have a slip-resistant surface. Marking stripes shall have a width of at least one inch (25 mm) but not more than two inches (51 mm).

1009.3.2 Profile. The radius of curvature at the leading edge of the tread shall be not greater than 0.5 inch (12.7 mm). Beveling of nosings shall not exceed 0.5 inch (12.7 mm). Risers shall be solid and vertical or sloped from the underside of the leading edge of the tread above at an angle not more than 30 degrees (0.52 rad) from the vertical. The leading edge (nosings) of treads shall project not more than 1.25 inches (32 mm) beyond the tread below and all projections of the leading edges shall be of uniform size, including the leading edge of the floor at the top of a flight.

Exceptions:

1. Solid risers are not required for stairways that are not required to comply with 780 CMR 1007.3, provided that the opening between treads does not permit the passage of a sphere

with a diameter of 4 inches (102 mm).

2. Solid risers are not required for occupancies in Group I-3.

1009.4 Stairway Landings. There shall be a floor or landing at the top and bottom of each stairway. The width of landings shall not be less than the width of stairways they serve. Every landing shall have a minimum dimension measured in the direction of travel equal to the width of the stairway. Such dimension need not exceed 48 inches (1219 mm) where the stairway has a straight run.

Exceptions:

1. Aisle stairs complying with 780 CMR 1024.
2. Doors opening onto a landing shall not reduce the landing to less than one-half the required width. When fully open, the door shall not project more than seven inches (178 mm) into a landing.

1009.5 Stairway Construction. All stairways shall be built of materials consistent with the types permitted for the type of construction of the building, except that wood handrails shall be permitted for all types of construction.

1009.5.1 Stairway Walking Surface. The walking surface of treads and landings of a stairway shall not be sloped steeper than one unit vertical in 48 units horizontal (2% slope) in any direction. Stairway treads and landings shall have a solid surface. Finish floor surfaces shall be securely attached.

Exception. In Group F, H and S occupancies, other than areas of parking structures accessible to the public, openings in treads and landings shall not be prohibited provided a sphere with a diameter of 1⅛ inches (29 mm) cannot pass through the opening.

1009.5.2 Outdoor Conditions. Outdoor stairways and outdoor approaches to stairways shall be designed so that water will not accumulate on walking surfaces. In other than occupancies in Group R-3, and occupancies in Group U that are accessory to an occupancy in Group R-3, treads, platforms and landings that are part of exterior stairways in climates subject to snow or ice shall be protected to prevent the accumulation of same.

1009.6 Vertical Rise. A flight of stairs shall not have a vertical rise greater than 12 feet (3658 mm) between floor levels or landings.

Exception: Aisle stairs complying with 780 CMR 1024.0.

1009.7 Circular Stairways. Circular stairways shall have a minimum tread depth and a maximum riser height in accordance with 780 CMR 1009.3 and the smaller radius shall not be less than twice the width of the stairway. The minimum tread depth measured 12 inches (305 mm) from the narrower end of the tread shall not be less than 11 inches (279 mm). The minimum tread depth at the narrow end shall not be less than ten inches (254 mm).

Exception. For occupancies in Group R-3, and within individual dwelling units in occupancies in Group R-2, both as applicable in 780 CMR 101.2.

1009.8 Winders. Winders are not permitted in means of egress stairways except within a dwelling unit.

1009.9 Spiral Stairways. Spiral stairways are permitted to be used as a component in the means of egress only within dwelling units or from a space not more than 250 square feet (23 m^2) in area and serving not more than five occupants, or from galleries, catwalks and gridirons in accordance with 780 CMR 1014.6.

A spiral stairway shall have a 7.5-inch (191 mm) minimum clear tread depth at a point 12 inches (305 mm) from the narrow edge. The risers shall be sufficient to provide a headroom of 78 inches (1981 mm) minimum, but riser height shall not be more than 9.5 inches (241 mm). The minimum stairway width shall be 26 inches (660 mm).

1009.10 Alternating Tread Devices. Alternating tread devices are limited to an element of a means of egress in buildings of Groups F, H and S from a mezzanine not more than 250 square feet (23 m^2) in area and which serves not more than five occupants; in buildings of Group I-3 from a guard tower, observation station or control room not more than 250 square feet (23 m^2) in area and for access to unoccupied roofs.

1009.10.1 Handrails of Alternating Tread Devices. Handrails shall be provided on both sides of alternating tread devices and shall conform to 780 CMR 1009.11.

1009.10.2 Treads of Alternating Tread Devices. Alternating tread devices shall have a minimum projected tread of 5 inches (127 mm), a minimum tread depth of 8.5 inches (216 mm), a minimum tread width of seven inches (178 mm) and a maximum riser height of 9.5 inches (241 mm). The initial tread of the device shall begin at the same elevation as the platform, landing or floor surface.

Exception. Alternating tread devices used as an element of a means of egress in buildings from a mezzanine area not more than 250 square feet (23 m^2) in area which serves not more than five occupants shall have a minimum projected tread of 8.5 inches (216 mm) with a minimum tread depth of 10.5 inches (267 mm). The rise to the next alternating tread surface should not be more than eight inches (203 mm).

1009.11 Handrails. Stairways shall have handrails on each side. Handrails shall be adequate in strength and attachment in accordance with 780 CMR

1607.7. Handrails for ramps, where required by 780 CMR 1010.8, shall comply with 780 CMR 1009.11.

Exceptions:

1. Aisle stairs complying with 780 CMR 1024 provided with a center handrail need not have additional handrails.
2. Stairways within dwelling units, spiral stairways and aisle stairs serving seating only on one side are permitted to have a handrail on one side only.
3. Decks, patios and walkways that have a single change in elevation where the landing depth on each side of the change of elevation is greater than what is required for a landing do not require handrails.
4. In Group R-3 occupancies, a change in elevation consisting of a single riser at an entrance or egress door does not require handrails.
5. Changes in room elevations of only one riser within dwelling units and sleeping units in Group R-2 and R-3 occupancies do not require handrails.

1009.11.1 Height. Handrail height, measured above stair tread nosings, or finish surface of ramp slope, shall be uniform, not less than 34 inches (864 mm) and not more than 38 inches (965 mm).

1009.11.2 Intermediate Handrails. Intermediate handrails are required so that all portions of the stairway width required for egress capacity are within 30 inches (762 mm) of a handrail. On monumental stairs, handrails shall be located along the most direct path of egress travel.

1009.11.3 Handrail Graspability. Handrails with a circular cross section shall have an outside diameter of at least 1.25 inches (32 mm) and not greater than two inches (51 mm) or shall provide equivalent graspability. If the handrail is not circular, it shall have a perimeter dimension of at least four inches (102 mm) and not greater than 6.25 inches (160 mm) with a maximum cross-section dimension of 2.25 inches (57 mm). Edges shall have a minimum radius of 0.01 inch (0.25 mm).

1009.11.4 Continuity. Handrail-gripping surfaces shall be continuous, without interruption by newel posts or other obstructions.

Exceptions:

1. Handrails within dwelling units are permitted to be interrupted by a newel post at a stair landing.
2. Within a dwelling unit, the use of a volute, turnout or starting easing is allowed on the lowest tread.
3. Handrail brackets or balusters attached to the bottom surface of the handrail that do not project horizontally beyond the sides of the handrail within 1.5 inches (38 mm) of the bottom of the handrail shall not be considered to be obstructions and provided further that for each 0.5 inch (13 mm) of additional handrail perimeter dimension above 4 inches (102 mm), the vertical clearance dimension of 1.5 inches (38 mm) shall be permitted to be reduced by 0.125 inch (3 mm).

1009.11.5 Handrail Extensions. Handrails shall return to a wall, guard or the walking surface or shall be continuous to the handrail of an adjacent stair flight. Where handrails are not continuous between flights, the handrails shall extend horizontally at least 12 inches (305 mm) beyond the top riser and continue to slope for the depth of one tread beyond the bottom riser.

Exceptions:

1. Handrails within a dwelling unit that is not required to be accessible need extend only from the top riser to the bottom riser.
2. Aisle handrails in Group A occupancies in accordance with 780 CMR 1024.13.

1009.11.6 Clearance. Clear space between a handrail and a wall or other surface shall be a minimum of 1.5 inches (38 mm). A handrail and a wall or other surface adjacent to the handrail shall be free of any sharp or abrasive elements.

1009.11.7 Stairway Projections. Projections into the required width at each handrail shall not exceed 4.5 inches (114 mm) at or below the handrail height. Projections into the required width shall not be limited above the minimum headroom height required in 780 CMR 1009.2.

1009.12 Stairway to Roof. In buildings four or more stories in height above grade, one stairway shall extend to the roof surface, unless the roof has a slope steeper than four units vertical in 12 units horizontal (33% slope). In buildings without an occupied roof, access to the roof from the top story shall be permitted to be by an alternating tread device.

1009.12.1 Roof Access. Where a stairway is provided to a roof, access to the roof shall be provided through a penthouse complying with 780 CMR 1509.2.

Exception: In buildings without an occupied roof, access to the roof shall be permitted to be a roof hatch or trap door not less than 16 square feet (1.5 m^2) in area and having a minimum dimension of two feet (610 mm).

780 CMR 1010.0 RAMPS

1010.1 Scope. The provisions of 780 CMR 1010.0 shall apply to ramps used as a component of a means of egress. ***For A-2 nightclubs (A-2nc) also see 780 CMR 1024.***

Exceptions:

1. Other than ramps that are part of the accessible routes providing access in accordance with 780 CMR 1108.2.2 through 1108.2.4.1, ramped aisles within assembly rooms or spaces

shall conform to the provisions in 780 CMR 1024.11.

2. Curb ramps shall comply with *ICC A117.1.* ***and 521 CMR as noted in 780 CMR 1010.0.***

3. Vehicle ramps in parking garages for pedestrian exit access shall not be required to comply with 780 CMR 1010.3 through 1010.9 when they are not an accessible route serving accessible parking spaces, other required accessible elements or part of an accessible means of egress.

1010.2 Slope. Ramps used as part of a means of egress shall have a running slope not steeper than one unit vertical in 12 units horizontal (8% slope). The slope of other ramps shall not be steeper than one unit vertical in eight units horizontal (12.5% slope).

Exception: Aisle ramp slope in occupancies of Group A shall comply with 780 CMR 1024.11.

1010.3 Cross Slope. The slope measured perpendicular to the direction of travel of a ramp shall not be steeper than one unit vertical in 48 units horizontal (2% slope).

1010.4 Vertical rise. The rise for any ramp run shall be 30 inches (762 mm) maximum.

1010.5 Minimum Dimensions. The minimum dimensions of means of egress ramps shall comply with 780 CMR 1010.5.1 through 1010.5.3.

1010.5.1 Width. The minimum width of a means of egress ramp shall not be less than that required for corridors by 780 CMR 1016.2. The clear width of a ramp and the clear width between handrails, if provided, shall be 36 inches (914 mm) minimum.

1010.5.2 Headroom. The minimum headroom in all parts of the means of egress ramp shall not be less than 80 inches (2032 mm).

1010.5.3 Restrictions. Means of egress ramps shall not reduce in width in the direction of egress travel. Projections into the required ramp and landing width are prohibited. Doors opening onto a landing shall not reduce the clear width to less than 42 inches (1067 mm).

1010.6 Landings. Ramps shall have landings at the bottom and top of each ramp, points of turning, entrance, exits and at doors. Landings shall comply with 780 CMR 1010.6.1 through 1010.6.5.

1010.6.1 Slope. Landings shall have a slope not steeper than one unit vertical in 48 units horizontal (2% slope) in any direction. Changes in level are not permitted.

1010.6.2 Width. The landing shall be at least as wide as the widest ramp run adjoining the landing.

1010.6.3 Length. The landing length shall be 60 inches (1525 mm) minimum.

Exception. Landings in nonaccessible Group R-2 and R-3 individual dwelling units, as applicable in 780 CMR 101.2, are permitted to be 36 inches (914 mm) minimum.

1010.6.4 Change in Direction. Where changes in direction of travel occur at landings provided between ramp runs, the landing shall be 60 inches by 60 inches (1524 mm by 1524 mm) minimum.

Exception. Landings in nonaccessible Group R-2 and R-3 individual dwelling units, as applicable in 780 CMR 101.2, are permitted to be 36 inches by 36 inches (914 mm by 914 mm) minimum.

1010.6.5 Doorways. Where doorways are located adjacent to a ramp landing, maneuvering clearances required by ***521 CMR*** are permitted to overlap the required landing area.

1010.7 Ramp Construction. All ramps shall be built of materials consistent with the types permitted for the type of construction of the building; except that wood handrails shall be permitted for all types of construction. Ramps used as an exit shall conform to the applicable requirements of 780 CMR 1019.1 and 1019.1.1 through 1019.1.3 for vertical exit enclosures.

1010.7.1 Ramp Surface. The surface of ramps shall be of slip-resistant materials that are securely attached.

1010.7.2 Outdoor Conditions. Outdoor ramps and outdoor approaches to ramps shall be designed so that water will not accumulate on walking surfaces. In other than occupancies in Group R-3, and occupancies in Group U that are accessory to an occupancy in Group R-3, surfaces and landings which are part of exterior ramps in climates subject to snow or ice shall be designed to minimize the accumulation of same.

1010.8 Handrails. Ramps with a rise greater than six inches (152 mm) shall have handrails on both sides complying with 780 CMR 1009.11.

1010.9 Edge Protection. Edge protection complying with 780 CMR 1010.9.1 or 1010.9.2 shall be provided on each side of ramp runs and at each side of ramp landings.

Exceptions.

1. Edge protection is not required on ramps not required to have handrails ***unless so required by 521 CMR when applicable.***

2. Edge protection is not required on the sides of ramp landings serving an adjoining ramp run or stairway ***unless so required by 521 CMR when applicable.***

3. Edge protection is not required on the sides of ramp landings having a vertical dropoff of not more than 0.5 inch (13 mm) within ten inches (254 mm) horizontally of the required landing area ***unless so required by 521 CMR, when applicable.***

1010.9.1 Railings. A rail shall be mounted below the handrail 17 inches to 19 inches (432 mm to 483 mm) above the ramp or landing surface.

1010.9.2 Curb or Barrier. A curb or barrier shall be provided that prevents the passage of a four-inch-diameter (102 mm) sphere, where any portion of the sphere is within four inches (102 mm) of the floor or ground surface.

1010.10 Guards. Guards shall be provided where required by 780 CMR 1012 and shall be constructed in accordance with 780 CMR 1012.0 ***and 521 CMR when applicable***.

780 CMR 1011.0 EXIT SIGNS

1011.1 Where Required. Exits and exit access doors shall be marked by an approved exit sign readily visible from any direction of egress travel. Access to exits shall be marked by readily visible exit signs in cases where the exit or the path of egress travel is not immediately visible to the occupants. Exit sign placement shall be such that no point in an exit access corridor is more than 100 feet (30480 mm) or the listed viewing distance for the sign, whichever is less, from the nearest visible exit sign.

Exceptions:

1. Exit signs are not required in rooms or areas which require only one exit or exit access.
2. Main exterior exit doors or gates which obviously and clearly are identifiable as exits need not have exit signs where approved by the building official.
3. Exit signs are not required in occupancies in Group U and individual sleeping units or dwelling units in Group R-1, R-2 or R-3.
4. Exit signs are not required in sleeping areas in occupancies in Group I-3.
5. In occupancies in Groups A-4 and A-5, exit signs are not required on the seating side of vomitories or openings into seating areas where exit signs are provided in the concourse that are readily apparent from the vomitories. Egress lighting is provided to identify each vomitory or opening within the seating area in an emergency.

1011.2 Illumination. Exit signs shall be internally or externally illuminated.

Exception. Tactile signs required by 780 CMR 1011.3 need not be provided with illumination.

1011.3 Tactile Exit Signs. A tactile sign stating EXIT and complying with ***521 CMR*** shall be provided adjacent to each door to an egress stairway, an exit passageway and the exit discharge.

1011.4 Internally Illuminated Exit Signs. Internally illuminated exit signs shall be listed and labeled and shall be installed in accordance with the manufacturer's instructions and 780 CMR 2702.0. Exit signs shall be illuminated at all times.

1011.5 Externally Illuminated Exit Signs. Externally illuminated exit signs shall comply with 780 CMR 1011.5.1 through 1011.5.3.

1011.5.1 Graphics. Every exit sign and directional exit sign shall have plainly legible letters not less than six inches (152 mm) high with the principal strokes of the letters not less than 0.75 inch (19.1 mm) wide. The word "EXIT" shall have letters having a width not less than two inches (51 mm) wide except the letter "I," and the minimum spacing between letters shall not be less than 0.375 inch (9.5 mm). Signs larger than the minimum established in 780 CMR 1011.5 shall have letter widths, strokes and spacing in proportion to their height.

The word "EXIT" shall be in high contrast with the background and shall be clearly discernible when the exit sign illumination means is or is not energized. If an arrow is provided as part of the exit sign, the construction shall be such that the arrow direction cannot be readily changed.

1011.5.2 Exit Sign Illumination. The face of an exit sign illuminated from an external source shall have an intensity of not less than five foot-candles (54 lux).

1011.5.3 Power Source. Exit signs shall be illuminated at all times. To ensure continued illumination for a duration of not less than 90 minutes in case of primary power loss, the sign illumination means shall be connected to an emergency power system provided from storage batteries, unit equipment or an on-site generator. The installation of the emergency power system shall be in accordance with 780 CMR 2702.

Exception. Approved exit sign illumination means that provide continuous illumination independent of external power sources for a duration of not less than 90 minutes, in case of primary power loss, are not required to be connected to an emergency electrical system.

780 CMR 1012.0 GUARDS

1012.1 Where Required. Guards shall be located along open-sided walking surfaces, mezzanines, industrial equipment platforms, stairways, ramps and landings which are located more than 30 inches (762 mm) above the floor or grade below. Guards shall be adequate in strength and attachment in accordance with 780 CMR 1607.7. Guards shall also be located along glazed sides of stairways, ramps and landings that are located more than 30 inches (762 mm) above the floor or grade below where the glazing provided does not meet the strength and attachment requirements in 780 CMR 1607.7.

Exception. Guards are not required for the following locations:

1. On the loading side of loading docks or piers.
2. On the audience side of stages and raised platforms, including steps leading up to the stage

and raised platforms.

3. On raised stage and platform floor areas such as runways, ramps and side stages used for entertainment or presentations.

4. At vertical openings in the performance area of stages and platforms.

5. At elevated walking surfaces appurtenant to stages and platforms for access to and utilization of special lighting or equipment.

6. Along vehicle service pits not accessible to the public.

7. In assembly seating where guards in accordance with 780 CMR 1024.14 are permitted and provided.

1012.2 Height. Guards shall form a protective barrier not less than 42 inches (1067 mm) high, measured vertically above the leading edge of the tread, adjacent walking surface or adjacent seatboard.

Exceptions:

1. For occupancies in Group R-3, and within individual dwelling units in occupancies in Group R-2, both as applicable in 780 CMR 101.2, guards whose top rail also serves as a handrail shall have a height not less than 34 inches (864 mm) and not more than 38 inches (965 mm) measured vertically from the leading edge of the stair tread nosing.

2. The height in assembly seating areas shall be in accordance with 780 CMR 1024.14.

1012.3 Opening Limitations. Open guards shall have balusters or ornamental patterns such that a 4-inch-diameter (102 mm) sphere cannot pass through any opening up to a height of 34 inches (864 mm). From a height of 34 inches (864 mm) to 42 inches (1067 mm) above the adjacent walking surfaces, a sphere 8 inches (203 mm) in diameter shall not pass.

Exceptions:

1. The triangular openings formed by the riser, tread and bottom rail at the open side of a stairway shall be of a maximum size such that a sphere of six inches (152 mm) in diameter cannot pass through the opening.

2. At elevated walking surfaces for access to and use of electrical, mechanical or plumbing systems or equipment, guards shall have balusters or be of solid materials such that a sphere with a diameter of 21 inches (533 mm) cannot pass through any opening.

3. In areas which are not open to the public within occupancies in Group I-3, F, H or S, balusters, horizontal intermediate rails or other construction shall not permit a sphere with a diameter of 21 inches (533 mm) to pass through any opening.

4. In assembly seating areas, guards at the end of aisles where they terminate at a fascia of boxes, balconies and galleries shall have balusters or ornamental patterns such that a 4-inch-diameter (102 mm) sphere cannot pass through any opening up to a height of 26 inches (660 mm). From a height of 26 inches (660 mm) to 42 inches (1067 mm) above the adjacent walking surfaces, a sphere 8 inches (203 mm) in diameter shall not pass.

1012.4 Screen Porches. Porches and decks which are enclosed with insect screening shall be provided with guards where the walking surface is located more than 30 inches (762 mm) above the floor or grade below.

1012.5 Mechanical Equipment. Guards shall be provided where appliances, equipment, fans or other components that require service are located within ten feet (3048 mm) of a roof edge or open side of a walking surface and such edge or open side is located more than 30 inches (762 mm) above the floor, roof or grade below. The guard shall be constructed so as to prevent the passage of a 21-inch-diameter (533 mm) sphere.

780 CMR 1013.0 EXIT ACCESS

1013.1 General. ***For A-2 nightclubs (A-2nc) also see 780 CMR 1024, otherwise, t***he exit access arrangement shall comply with 780 CMR 1013.0 through 1016.0 and the applicable provisions of 780 CMR 1003.0 through 1012.0.

1013.2 Egress Through Intervening Spaces. Egress from a room or space shall not pass through adjoining or intervening rooms or areas, except where such adjoining rooms or areas are accessory to the area served; are not a high-hazard occupancy and provide a discernible path of egress travel to an exit. Egress shall not pass through kitchens, storage rooms, closets or spaces used for similar purposes. An exit access shall not pass through a room that can be locked to prevent egress. Means of egress from dwelling units or sleeping areas shall not lead through other sleeping areas, toilet rooms or bathrooms.

Exceptions:

1. Means of egress are not prohibited through a kitchen area serving adjoining rooms constituting part of the same dwelling unit or sleeping unit.

2. Means of egress are not prohibited through adjoining or intervening rooms or spaces in a Group H occupancy when the adjoining or intervening rooms or spaces are the same or a lesser hazard occupancy group.

1013.2.1 Multiple Tenants. Where more than one tenant occupies any one floor of a building or structure, each tenant space, dwelling unit and sleeping unit shall be provided with access to the required exits without passing through adjacent tenant spaces, dwelling units and sleeping units.

1013.2.2 Group I-2. Habitable rooms or suites in Group I-2 occupancies shall have an exit access door leading directly to an exit access corridor.

Exceptions:

1. Rooms with exit doors opening directly to the outside at ground level.
2. Patient sleeping rooms are permitted to have one intervening room if the intervening room is not used as an exit access for more than eight patient beds.
3. Special nursing suites are permitted to have one intervening room where the arrangement allows for direct and constant visual supervision by nursing personnel.
4. For rooms other than patient sleeping rooms, suites of rooms are permitted to have one intervening room if the travel distance within the suite to the exit access door is not greater than 100 feet (30 480 mm) and are permitted to have two intervening rooms where the travel distance within the suite to the exit access door is not greater than 50 feet (15 240 mm).

Suites of sleeping rooms shall not exceed 5,000 square feet (465 m^2). Suites of rooms, other than patient sleeping rooms, shall not exceed 10,000 square feet (929 m^2). Any patient sleeping room, or any suite that includes patient sleeping rooms, of more than 1,000 square feet (93 m^2) shall have at least two exit access doors remotely located from each other. Any room or suite of rooms, other than patient sleeping rooms, of more than 2,500 square feet (232 m^2) shall have at least two access doors remotely located from each other. The travel distance between any point in a Group I-2 occupancy and an exit access door in the room shall not exceed 50 feet (15 240 mm). The travel distance between any point in a suite of sleeping rooms and an exit access door of that suite shall not exceed 100 feet (30 480 mm).

1013.3 Common Path of Egress Travel. In occupancies other than Groups H-1, H-2 and H-3, the common path of egress travel shall not exceed 75 feet (22 860 mm). In occupancies in Groups H-1, H-2, and H-3, the common path of egress travel shall not exceed 25 feet (7620 mm).

Exceptions:

1. The length of a common path of egress travel in an occupancy in Groups B, F and S shall not be more than 100 feet (30 480 mm), provided that the building is equipped throughout with an automatic sprinkler system installed in accordance with 780 CMR 903.3.1.1.
2. Where a tenant space in an occupancy in Groups B, S and U has an occupant load of not more than 30, the length of a common path of egress travel shall not be more than 100 feet (30 480 mm).
3. The length of a common path of egress travel in occupancies in Group I-3 shall not be more than 100 feet (30 480 mm).

1013.4 Aisles. Aisles serving as a portion of the exit access in the means of egress system shall comply with the requirements of 780 CMR 1013.4. Aisles shall be provided from all occupied portions of the exit access which contain seats, tables, furnishings, displays and similar fixtures or equipment. Aisles serving assembly areas, other than seating at tables, shall comply with 780 CMR 1024.0. Aisles serving reviewing stands, grandstands and bleachers shall also comply with 780 CMR 1024.0.

The required width of aisles shall be unobstructed.

Exception: Doors, when fully opened, and handrails shall not reduce the required width by more than seven inches (178 mm). Doors in any position shall not reduce the required width by more than ½. Other nonstructural projections such as trim and similar decorative features are permitted to project into the required width 1.5 inches (38 mm) from each side.

1013.4.1 Groups B and M. In Group B and M occupancies, the minimum clear aisle width shall be determined by 780 CMR 1005.1 for the occupant load served, but shall not be less than 36 inches (914 mm).

Exception: Nonpublic aisles serving less than 50 people, and not required to be accessible by 780 CMR 11 need not exceed 28 inches (711 mm) in width.

1013.4.2 Seating at Tables. Where seating is located at a table or counter and is adjacent to an aisle or aisle accessway, the measurement of required clear width of the aisle or aisle accessway shall be made to a line 19 inches (483 mm) away from and parallel to the edge of the table or counter. The 19-inch (483 mm) distance shall be measured perpendicular to the side of the table or counter. In the case of other side boundaries for aisle or aisle accessways, the clear width shall be measured to walls, edges of seating and tread edges, except that handrail projections are permitted.

Exception: Where tables or counters are served by fixed seats, the width of the aisle accessway shall be measured from the back of the seat.

1013.4.2.1 Aisle Accessway for Tables and Seating. Aisle accessways serving arrangements of seating at tables or counters shall have sufficient clear width to conform to the capacity requirements of 780 CMR 1005.1 but shall not have less than the appropriate minimum clear width specified in 780 CMR 1013.4.1.

1013.4.2.2 Table and Seating Accessway Width. Aisle accessways shall provide a minimum of 12 inches (305 mm) of width plus 0.5 inch (12.7 mm) of width for each additional one foot (305 mm), or fraction thereof, beyond 12 feet (3658 mm) of aisle accessway length measured from the center of the seat farthest from an aisle.

Exception: Portions of an aisle accessway having a length not exceeding six feet (1829 mm) and used by a total of not more than four persons.

1013.4.2.3 Table and Seating Aisle Accessway Length. The length of travel along the aisle accessway shall not exceed 30 feet (9144 mm) from any seat to the point where a person has a choice of two or more paths of egress travel to separate exits.

1013.5 Egress Balconies. Balconies used for egress purposes shall conform to the same requirements as corridors for width, headroom, dead ends and projections. Exterior balconies shall be designed to minimize accumulation of snow or ice that impedes the means of egress.

Exception. Exterior balconies and concourses in outdoor stadiums shall be exempt from the design requirement to protect against the accumulation of snow or ice.

1013.5.1 Wall Separation. Exterior egress balconies shall be separated from the interior of the building by walls and opening protectives as required for corridors.

Exception. Separation is not required where the exterior egress balcony is served by at least two stairs and a dead-end travel condition does not require travel past an unprotected opening to reach a stair.

1013.5.2 Openness. The long side of an egress balcony shall be at least 50% open, and the open area above the guards shall be so distributed as to minimize the accumulation of smoke or toxic gases.

780 CMR 1014.0 EXIT AND EXIT ACCESS DOORWAYS

1014.1 Exit or Exit Access Doorways Required. ***For A-2 nightclubs (A-2nc) also see 780 CMR 1024.0, otherwise***, two exits or exit access doorways from any space shall be provided where one of the following conditions exists:

1. The occupant load of the space exceeds the values in Table 1014.1.
2. The common path of egress travel exceeds the limitations of 780 CMR 1013.3.
3. Where required by 780 CMR 1014.3, 1014.4 and 1014.5.

Exception. Group I-2 occupancies shall comply with 780 CMR 1013.2.2.

TABLE 1014.1 SPACES WITH ONE MEANS OF EGRESS

OCCUPANCY	MAXIMUM OCCUPANT LOAD
A, B, E, F, M, U	50
H-1, H-2, H-3	3
H-4, H-5, I-1, I-3, I-4, R	10
S	30

1014.1.1 Three or More exits. Access to three or more exits shall be provided from a floor area where required by 780 CMR 1018.1.

1014.2 Exit or Exit Access Doorway Arrangement. Required exits shall be located in a manner that makes their availability obvious. Exits shall be unobstructed at all times. Exit and exit access doorways shall be arranged in accordance with 780 CMR 1014.2.1 and 1014.2.2.

1014.2.1 Two Exits or Exit Access Doorways. Where two exits or exit access doorways are required from any portion of the exit access, the exit doors or exit access doorways shall be placed a distance apart equal to not less than ½ of the length of the maximum overall diagonal dimension of the building or area to be served measured in a straight line between exit doors or exit access doorways. Interlocking or scissor stairs shall be counted as one exit stairway.

Exceptions:

1. Where exit enclosures are provided as a portion of the required exit and are interconnected by a one-hour fire-resistance-rated corridor conforming to the requirements of 780 CMR 1016, the required exit separation shall be measured along the shortest direct line of travel within the corridor.
2. Where a building is equipped throughout with an automatic sprinkler system in accordance with 780 CMR 903.3.1.1 or 903.3.1.2, the separation distance of the exit doors or exit access doorways shall not be less than one-third of the length of the maximum overall diagonal dimension of the area served.

1014.2.2 Three or More Exits or Exit Access Doorways. Where access to three or more exits is required, at least two exit doors or exit access doorways shall be placed a distance apart equal to not less than ½ of the length of the maximum overall diagonal dimension of the area served measured in a straight line between such exit doors or exit access doorways. Additional exits or exit access doorways shall be arranged a reasonable distance apart so that if one becomes blocked, the others will be available.

Exception. Where a building is equipped throughout with an automatic sprinkler system in accordance with 780 CMR 903.3.1.1 or 903.3.1.2, the separation distance of at least two of the exit doors or exit access doorways shall not be less than ⅓ of the length of the maximum overall diagonal dimension of the area served.

1014.3 Boiler, Incinerator and Furnace Rooms. Two exit access doorways are required in boiler, incinerator and furnace rooms where the area is over 500 square feet (46 m^2) and any fuel-fired equipment exceeds 400,000 British thermal units (Btu) (422 000 KJ) input capacity. Where two exit access doorways are required, one is permitted to be a fixed ladder or an alternating tread device. Exit access doorways shall be separated by a horizontal distance equal to ½ the maximum horizontal dimension of the room.

1014.4 Refrigeration Machinery Rooms. Machinery rooms larger than 1,000 square feet (93 m^2) shall have not less than two exits or exit access doors. Where two exit access doorways are required, one such doorway is permitted to be served by a fixed ladder or an alternating tread device. Exit access doorways shall be separated by a horizontal distance equal to one-half the maximum horizontal dimension of room.

All portions of machinery rooms shall be within 150 feet (45 720 mm) of an exit or exit access doorway. An increase in travel distance is permitted in accordance with 780 CMR 1015.1.

Doors shall swing in the direction of egress travel, regardless of the occupant load served. Doors shall be tight fitting and self-closing.

1014.5 Refrigerated Rooms or Spaces. Rooms or spaces having a floor area of 1,000 square feet (93 m^2) or more, containing a refrigerant evaporator and maintained at a temperature below 68°F (20°C), shall have access to not less than two exits or exit access doors.

Travel distance shall be determined as specified in 780 CMR 1015.1, but all portions of a refrigerated room or space shall be within 150 feet (45 720 mm) of an exit or exit access door where such rooms are not protected by an approved automatic sprinkler system. Egress is allowed through adjoining refrigerated rooms or spaces.

Exception. Where using refrigerants in quantities limited to the amounts based on the volume set forth in the *International Mechanical Code*.

1014.6 Stage Means of Egress. Where two means of egress are required, based on the stage size or occupant load, one means of egress shall be provided on each side of the stage.

1014.6.1 Gallery, Gridiron and Catwalk Means of Egress. The means of egress from lighting and access catwalks, galleries and gridirons shall meet the requirements for occupancies in Group F-2.

Exceptions:

1. A minimum width of 22 inches (559 mm) is permitted for lighting and access catwalks.
2. Spiral stairs are permitted in the means of egress.
3. Stairways required by 780 CMR 1014.6.1 need not be enclosed.
4. Stairways with a minimum width of 22 inches (559 mm), ladders, or spiral stairs are permitted in the means of egress.
5. A second means of egress is not required from these areas where a means of escape to a floor or to a roof is provided. Ladders, alternating tread devices or spiral stairs are permitted in the means of escape.
6. Ladders are permitted in the means of egress.

780 CMR 1015.0 EXIT ACCESS TRAVEL DISTANCE

1015.1 Travel Distance Limitations. Exits shall be so located on each story such that the maximum length of exit access travel, measured from the most remote point within a story to the entrance to an exit along the natural and unobstructed path of egress travel, shall not exceed the distances given in Table 1015.1.

Where the path of exit access includes unenclosed stairways or ramps within the exit access or includes unenclosed exit ramps or stairways as permitted in 780 CMR 1019.1, the distance of travel on such means of egress components shall also be included in the travel distance measurement. The measurement along stairways shall be made on a plane parallel and tangent to the stair tread nosings in the center of the stairway.

Exceptions:

1. Travel distance in open parking garages is permitted to be measured to the closest riser of open stairs.
2. In outdoor facilities with open exit access components and open exterior stairs or ramps, travel distance is permitted to be measured to the closest riser of a stair or the closest slope of the ramp.
3. Where an exit stair is permitted to be unenclosed in accordance with 780 CMR 1019.1, Exception 8. or 9. the travel distance shall be measured from the most remote point within a building to an exit discharge.

TABLE 1015.1 EXIT ACCESS TRAVEL DISTANCE

OCCUPANCY	WITHOUT SPRINKLER SYSTEM (feet)	WITH SPRINKLER SYSTEM (feet)
A, E, F-1, I-1, M, R, S-1	200	250[b]
B	200	300[c]
F-2, S-2, U	300	400[b]
H-1	Not Permitted	75[c]
H-2	Not Permitted	100[c]
H-3	Not Permitted	150[c]
H-4	Not Permitted	175[c]
H-5	Not Permitted	200[c]
I-2, I-3, I-4	150	200[c]

For SI: 1 foot = 304.8 mm.

a. See the following sections for modifications to exit access travel distance requirements:
780 CMR 402.0 for the distance limitation in malls.
780 CMR 404.0 for the distance limitation through an atrium space.
780 CMR 1015.2 for increased limitation in Groups F-1 and S-1.
780 CMR 1024.7 for increased limitation in assembly seating.
780 CMR 1024.7 for increased limitation for assembly open-air seating.
780 CMR 1018.2 for buildings with one exit.
780 CMR 31.00 for the limitation in temporary structures.

b. Buildings equipped throughout with an automatic sprinkler system in accordance with 780 CMR 903.3.1.1 or 903.3.1.2. See 780 CMR 903.0 for occupancies where sprinkler systems according to 780 CMR 903.3.1.2 are permitted.

c. Buildings equipped throughout with an automatic sprinkler system in accordance with 780 CMR 903.3.1.1.

1015.2 Roof Vent Increase. In buildings which are one story in height, equipped with automatic heat and smoke roof vents complying with 780 CMR 910.0 and equipped throughout with an automatic sprinkler system in accordance with 780 CMR 903.3.1.1, the maximum exit access travel distance shall be 400 feet (122 m) for occupancies in Group F-1 or S.

1015.3 Exterior Egress Balcony Increase. Travel distances specified in 780 CMR 1015.1 shall be increased up to an additional 100 feet (30 480 mm) provided the last portion of the exit access leading to the exit occurs on an exterior egress balcony constructed in accordance with 780 CMR 1013.5. The length of such balcony shall not be less than the amount of the increase taken.

780 CMR 1016.0 CORRIDORS

1016.1 Construction. Corridors shall be fire-resistance rated in accordance with Table 1016.1. The corridor walls required to be fire-resistance rated shall comply with 780 CMR 708.0 for fire partitions.

Exceptions:

1. A fire-resistance rating is not required for corridors in an occupancy in Group E where each room that is used for instruction has at least one door directly to the exterior and rooms for assembly purposes have at least ½ of the required means of egress doors opening directly to the exterior. Exterior doors specified in this exception are required to be at ground level.
2. A fire-resistance rating is not required for corridors contained within a dwelling or sleeping unit in an occupancy in Group R.
3. A fire-resistance rating is not required for corridors in open parking garages.
4. A fire-resistance rating is not required for corridors in an occupancy in Group B which is a space requiring only a single means of egress complying with 780 CMR 1014.1.

TABLE 1016.1 CORRIDOR FIRE-RESISTANCE RATING

OCCUPANCY	OCCUPANT LOAD SERVED BY CORRIDOR	REQUIRED FIRE-RESISTANCE RATING (hours)	
		Without sprinkler system	With sprinkler system[c]
H-1, H-2, H-3	All	Not Permitted	1
H-4, H-5	Greater than 30	Not Permitted	1
A, B, E, F, M, S, U	Greater than 30	1	0
R	Greater than 10	Not Permitted	0.5
I-2[a], I-4	All	Not Permitted	0
I-1, I-3	All	Not Permitted	1[b]

a. For requirements for occupancies in Group I-2, see 780 CMR 407.3.

b. For a reduction in the fire-resistance rating for occupancies in Group I-3, see 780 CMR 408.7.

c. Buildings equipped throughout with an automatic sprinkler system in accordance with 780 CMR 903 .3.1.1 or 903.3.1.2 where allowed.

1016.2 Corridor Width. ***For A-2 nightclubs (A-2nc) also see 780 CMR 1024.0***. The minimum corridor width shall be as determined in 780 CMR 1005.1, but not less than 44 inches (1118 mm).

Exceptions:

1. 24 inches (610 mm)—For access to and utilization of electrical, mechanical or plumbing systems or equipment.
2. 36 inches (914 mm)—With a required occupant capacity of 50 or less.
3. 36 inches (914 mm)—Within a dwelling unit.
4. 72 inches (1829 mm)—In Group E with a corridor having a required capacity of 100 or more.
5. 72 inches (1829 mm)—In corridors serving surgical Group I, health care centers for ambulatory patients receiving outpatient medical care, which causes the patient to be not capable of self-preservation.
6. 96 inches (2438 mm)—In Group I-2 in areas where required for bed movement.

1016.3 Dead Ends. Where more than one exit or exit access doorway is required, the exit access shall be arranged such that there are no dead ends in corridors more than 20 feet (6096 mm) in length.

Exceptions:

1. In occupancies in Group I-3 of Occupancy Condition 2, 3 or 4 (see 780 CMR 308.4), the dead end in a corridor shall not exceed 50 feet (15 240 mm).
2. In occupancies in Groups B and F where the building is equipped throughout with an automatic sprinkler system in accordance with 780 CMR 903.3.1.1, the length of dead-end corridors shall not exceed 50 feet (15 240 mm).
3. A dead-end corridor shall not be limited in length where the length of the dead-end corridor is less than 2.5 times the least width of the dead-end corridor.

1016.4 Air Movement in Corridors. Exit access corridors shall not serve as supply, return, exhaust, relief or ventilation air ducts or plenums.

Exceptions:

1. Use of a corridor as a source of makeup air for exhaust systems in rooms that open directly onto such corridors, including toilet rooms, bathrooms, dressing rooms, smoking lounges and janitor closets, shall be permitted provided that each such corridor is directly supplied with outdoor air at a rate greater than the rate of makeup air taken from the corridor.
2. Where located within a dwelling unit, the use of corridors for conveying return air shall not be prohibited.
3. Where located within tenant spaces of 1,000 square feet (93 m^2) or less in area, utilization of corridors for conveying return air is permitted.

1016.4.1 Corridor Ceiling. Use of the space between the corridor ceiling and the floor or roof structure above as a return air plenum is permitted for one or more of the following conditions:

1. The corridor is not required to be of fire-resistance-rated construction;
2. The corridor is separated from the plenum by fire-resistance-rated construction;
3. The air-handling system serving the corridor is shut down upon activation of the air-handling unit smoke detectors required by the *International Mechanical Code*.
4. The air-handling system serving the corridor is shut down upon detection of sprinkler waterflow where the building is equipped throughout with an automatic sprinkler system; or
5. The space between the corridor ceiling and the floor or roof structure above the corridor is used as a component of an approved engineered smoke control system.

1016.5 Corridor Continuity. Fire-resistance-rated corridors shall be continuous from the point of entry to an exit, and shall not be interrupted by intervening rooms.

Exception. Foyers, lobbies or reception rooms constructed as required for corridors shall not be construed as intervening rooms.

780 CMR 1017.0 EXITS

1017.1 General. ***For A-2 nightclubs (A-2nc) also see 780 CMR 1024***. Exits shall comply with 780 CMR 1017 through 1022 and the applicable requirements of 780 CMR 1003 through 1012. An exit shall not be used for any purpose that interferes with its function as a means of egress. Once a given level of exit protection is achieved, such level of protection shall not be reduced until arrival at the exit discharge.

1017.2 Exterior Exit Doors. Buildings or structures used for human occupancy shall have at least one exterior door that meets the requirements of 780 CMR 1008.1.1.

1017.2.1 Detailed Requirements. Exterior exit doors shall comply with the applicable requirements of 780 CMR 1008.1.

1017.2.2 Arrangement. Exterior exit doors shall lead directly to the exit discharge or the public way.

780 CMR 1018.0 NUMBER OF EXITS AND CONTINUITY

1018.1 Minimum Number of Exits. ***For A-2 nightclubs (A-2nc) also see 780 CMR 1024***. All rooms and spaces within each story shall be provided with and have access to the minimum number of approved independent exits as required by Table 1018.1 based on the occupant load, except as modified in 780 CMR 1014.1 or 1018.2. For the purposes of 780 CMR 10.00, occupied roofs shall be provided with exits as required for stories. The required number of exits from any story, basement or individual space shall be maintained until arrival at grade or the public way.

TABLE 1018.1 MINIMUM NUMBER OF EXITS FOR OCCUPANT LOAD

OCCUPANT LOAD	MINIMUM NUMBER OF EXITS
1-500	2
501-1,000	3
More than 1,000	4

1018.1.1 Open Parking Structures. Parking structures shall not have less than two exits from each parking tier, except that only one exit is required where vehicles are mechanically parked. Unenclosed vehicle ramps shall not be considered as required exits unless pedestrian facilities are provided.

1018.1.2 Helistops. The means of egress from helistops shall comply with the provisions of 780 CMR 10.00, provided that landing areas located on buildings or structures shall have two or more exits. For landing platforms or roof areas less than 60 feet (18 288 mm) long, or less than 2,000 square feet (186 m^2) in area, the second means of egress is permitted to be a fire escape or ladder leading to the floor below.

1018.2 Buildings with One Exit. Only one exit shall be required in buildings as described in 780 CMR 1018.2, Items 1. through 3.:

1. Buildings described in Table 1018.2, provided that the building has not more than one level below the first story above grade plane.
2. Buildings of Group R-3 occupancy.
3. Single-level buildings with the occupied space at the level of exit discharge provided that the story or space complies with 780 CMR 1014.1 as a space with one means of egress.

TABLE 1018.2 BUILDINGS WITH ONE EXIT

OCCUPANCY	MAXIMUM HEIGHT OF BUILDING ABOVE GRADE PLANE	MAXIMUM OCCUPANTS (OR DWELLING UNITS) PER FLOOR AND TRAVEL DISTANCE
A, B[d], E, F, M, U	1 Story	50 occupants and 75 feet travel distance
H-2, H-3	1 Story	3 occupants and 25 feet travel distance
H-4, H-5, I, R	1 Story	10 occupants and 75 feet travel distance
S[a]	1 Story	30 occupants and 100 feet travel distance
B[b], F, M, S[a]	2 Stories	30 occupants and 75 feet travel distance
R-2	2 Stories[c]	4 dwelling units and 50 feet travel distance

For SI: 1 foot = 304.8 mm.

a. For the required number of exits for open parking structures, see 780 CMR 1018.1.1.

b. For the required number of exits for air traffic control towers, see 780 CMR 412. 1.

c. Buildings classified as Group R-2 equipped throughout with an automatic sprinkler system in accordance with 780 CMR 903.3.1.1 or 903.3.1.2 and provided with emergency escape and rescue openings in accordance with 780 CMR 1025 shall have a maximum height of three stories above grade.

d. Buildings equipped throughout with an automatic sprinkler system in accordance with 780 CMR 903.3.1.1 with an occupancy in Group B shall have a maximum travel distance of 100 feet.

1018.3 Exit Continuity. Exits shall be continuous from the point of entry into the exit to the exit discharge.

1018.4 Exit Door Arrangement. Exit door arrangement shall meet the requirements of 780 CMR 1014.2 through 1014.2.2.

780 CMR 1019.0 VERTICAL EXIT ENCLOSURES

1019.1 Enclosures Required. Interior exit stairways and interior exit ramps shall be enclosed with fire barriers. Exit enclosures shall have a fire-resistance rating of not less than two hours where connecting four stories or more and not less than one hour where connecting less than four stories. The number of stories connected by the shaft enclosure shall include any basements but not any mezzanines. An exit enclosure shall not be used for any purpose other than means of egress. Enclosures shall be constructed as fire barriers in accordance with 780 CMR 706.

Exceptions:

1. In other than Group H and I occupancies, a stairway serving an occupant load of less than ten not more than one story above the level of exit discharge is not required to be enclosed.
2. Exits in buildings of Group A-5 where all portions of the means of egress are essentially open to the outside need not be enclosed.
3. Stairways serving and contained within a single residential dwelling unit or sleeping unit in occupancies in Group R-2 or R-3 and sleeping units in occupancies in Group R-1 are not required to be enclosed.
4. Stairways that are not a required means of egress element are not required to be enclosed where such stairways comply with 780 CMR 707.2.
5. Stairways in open parking structures which serve only the parking structure are not required to be enclosed.
6. Stairways in occupancies in Group I-3 as provided for in 780 CMR 408.3.6 are not required to be enclosed.
7. Means of egress stairways as required by 780 CMR 410.5.4 are not required to be enclosed.

8. In other than occupancy Groups H and I, a maximum of 50% of egress stairways serving one adjacent floor are not required to be enclosed, provided at least two means of egress are provided from both floors served by the unenclosed stairways. Any two such interconnected floors shall not be open to other floors.

9. In other than occupancy Groups H and I, interior egress stairways serving only the first and second stories of a building equipped throughout with an automatic sprinkler system in accordance with 780 CMR 903.3.1.1 are not required to be enclosed, provided at least two means of egress are provided from both floors served by the unenclosed stairways. Such interconnected stories shall not be open to other stories.

1019.1.1 Openings and Penetrations. Exit enclosure opening protectives shall be in accordance with the requirements of 780 CMR 715.0.

Except as permitted in 780 CMR 402.4.6, openings in exit enclosures other than unexposed exterior openings shall be limited to those necessary for exit access to the enclosure from normally occupied spaces and for egress from the enclosure.

Where interior exit enclosures are extended to the exterior of a building by an exit passageway, the door assembly from the exit enclosure to the exit passageway shall be protected by a fire door conforming to the requirements in 780 CMR 715.3. Fire door assemblies in exit enclosures shall comply with 780 CMR 715.3.4.

1019.1.2 Penetrations. Penetrations into and openings through an exit enclosure are prohibited except for required exit doors, equipment and ductwork necessary for independent pressurization, sprinkler piping, standpipes, electrical raceway for fire department communication and electrical raceway serving the exit enclosure and terminating at a steel box not exceeding 16 square inches (0.010 m^2). Such penetrations shall be protected in accordance with 780 CMR 712.0. There shall be no penetrations or communication openings, whether protected or not, between adjacent exit enclosures.

1019.1.3 Ventilation. Equipment and ductwork for exit enclosure ventilation shall comply with one of 780 CMR 1019.1.3, Items 1. through 3.:

1. Such equipment and ductwork shall be located exterior to the building and shall be directly connected to the exit enclosure by ductwork enclosed in construction as required for shafts.
2. Where such equipment and ductwork is located within the exit enclosure, the intake air shall be taken directly from the outdoors and the exhaust air shall be discharged directly to the outdoors, or such air shall be conveyed through ducts enclosed in construction as required for shafts.
3. Where located within the building, such equipment and ductwork shall be separated from the remainder of the building, including other mechanical equipment, with construction as required for shafts.

In each case, openings into the fire-resistance-rated construction shall be limited to those needed for maintenance and operation and shall be protected by self-closing fire-resistance-rated devices in accordance with 780 CMR 7.00 for enclosure wall opening protectives.

Exit enclosure ventilation systems shall be independent of other building ventilation systems.

1019.1.4 Vertical Enclosure Exterior Walls. Exterior walls of a vertical exit enclosure shall comply with the requirements of 780 CMR 704 for exterior walls. Where nonrated walls or unprotected openings enclose the exterior of the stairway and the walls or openings are exposed by other parts of the building at an angle of less than 180 degrees (3.14 rad), the building exterior walls within ten feet (3048 mm) horizontally of a nonrated wall or unprotected opening shall be constructed as required for a minimum pne-hour fire-resistance rating with ¾-hour opening protectives. This construction shall extend vertically from the ground to a point ten feet (3048 mm) above the topmost landing of the stairway or to the roof line, whichever is lower.

1019.1.5 Enclosures under Stairways. The walls and soffits within enclosed usable spaces under enclosed and unenclosed stairways shall be protected by one-hour fire-resistance-rated construction, or the fire-resistance rating of the stairway enclosure, whichever is greater. Access to the enclosed usable space shall not be directly from within the stair enclosure.

Exception. Spaces under stairways serving and contained within a single residential dwelling unit in Group R-2 or R-3 as applicable in 780 CMR 101.2.

There shall be no enclosed usable space under exterior exit stairways unless the space is completely enclosed in one-hour fire-resistance-rated construction. The open space under exterior stairways shall not be used for any purpose.

1019.1.6 Discharge Identification. A stairway in an exit enclosure shall not continue below the level of exit discharge unless an approved barrier is provided at the level of exit discharge to prevent persons from unintentionally continuing into levels below. Directional exit signs shall be provided as specified in 780 CMR 1011.0.

1019.1.7 Stairway Floor Number Signs. A sign shall be provided at each floor landing in interior vertical exit enclosures connecting more than three stories designating the floor level, the terminus of the top and bottom of the stair enclosure and the identification of the stair. The signage shall also state the story of, and the direction to the exit discharge and the availability of roof access from the stairway for the fire department. The sign shall be located five feet (1524 mm) above the floor landing in a position which is readily visible when the doors are in the open and closed positions.

1019.1.8 Smokeproof Enclosures. In buildings required to comply with 780 CMR 403.0 or 405.0, each of the exits of a building that serves stories where the floor surface is located more than 75 feet (22 860 mm) above the lowest level of fire department vehicle access or more than 30 feet (9144 mm) below the level of exit discharge serving such floor levels shall be a smokeproof enclosure or pressurized stairway in accordance with 780 CMR 909.20.

1019.1.8.1 Enclosure Exit. A smokeproof enclosure or pressurized stairway shall exit into a public way or into an exit passageway, yard or open space having direct access to a public way. The exit passageway shall be without other openings and shall be separated from the remainder of the building by two-hour fire-resistance-rated construction.

Exceptions:

1. Openings in the exit passageway serving a smokeproof enclosure are permitted where the exit passageway is protected and pressurized in the same manner as the smokeproof enclosure, and openings are protected as required for access from other floors.
2. Openings in the exit passageway serving a pressurized stairway are permitted where the exit passageway is protected and pressurized in the same manner as the pressurized stairway.

1019.1.8.2 Enclosure Access. Access to the stairway within a smokeproof enclosure shall be by way of a vestibule or an open exterior balcony.

Exception. Access is not required by way of a vestibule or exterior balcony for stairways using the pressurization alternative complying with 780 CMR 909.20.5.

780 CMR 1020.0 EXIT PASSAGEWAYS

1020.1 Exit Passageway. ***For A-2 nightclubs (A-2nc) also see 780 CMR 1024***. Exit passageways serving as an exit component in a means of egress system shall comply with the requirements of 780 CMR 1020.0. An exit passageway shall not be used for any purpose other than as a means of egress.

1020.2 Width. The width of exit passageways shall be determined as specified in 780 CMR 1005.1 but such width shall not be less than 44 inches (1118 mm), except that exit passageways serving an occupant load of less than 50 shall not be less than 36 inches (914 mm) in width.

The required width of exit passageways shall be unobstructed.

Exception. Doors, when fully opened, and handrails, shall not reduce the required width by more than seven inches (178 mm). Doors in any position shall not reduce the required width by more than ½. Other nonstructural projections such as trim and similar decorative features are permitted to project into the required width 1½ inches (38 mm) on each side.

1020.3 Construction. Exit passageway enclosures shall have walls, floors and ceilings of not less than one-hour fire-resistance rating, and not less than that required for any connecting exit enclosure. Exit passageways shall be constructed as fire barriers in accordance with 780 CMR 706.

1020.4 Openings and Penetrations. Exit passageway opening protectives shall be in accordance with the requirements of 780 CMR 715.0.

Except as permitted in 780 CMR 402.4.6, openings in exit passageways other than unexposed exterior openings shall be limited to those necessary for exit access to the exit passageway from normally occupied spaces and for egress from the exit passageway.

Where interior exit enclosures are extended to the exterior of a building by an exit passageway, the door assembly from the exit enclosure to the exit passageway shall be protected by a fire door conforming to the requirements in 780 CMR 715.3. Fire door assemblies in exit passageways shall comply with 780 CMR 715.3.4.

Elevators shall not open into an exit passageway.

1020.5 Penetrations. Penetrations into and openings through an exit passageway are prohibited except for required exit doors, equipment and ductwork necessary for independent pressurization, sprinkler piping, standpipes, electrical raceway for fire department communication and electrical raceway serving the exit passageway and terminating at a steel box not exceeding 16 square inches (0.010 m^2). Such penetrations shall be protected in accordance with 780 CMR 712.0. There shall be no penetrations or communicating openings, whether protected or not, between adjacent exit passageways.

780 CMR 1021.0 HORIZONTAL EXITS

1021.1 Horizontal Exits. ***For A-2 nightclubs (A-2nc) also see 780 CMR 1024***. Horizontal exits serving as an exit in a means of egress system shall comply with the requirements of 780 CMR 1021.0. A horizontal exit shall not serve as the only exit from a portion of a building, and where two or more exits are required, not more than ½ of the total number of exits or total exit width shall be horizontal exits.

Exceptions:

1. Horizontal exits are permitted to comprise two-thirds of the required exits from any building or floor area for occupancies in Group I-2.
2. Horizontal exits are permitted to comprise 100% of the exits required for occupancies in Group I-3. At least six square feet (0.6 m^2) of accessible space per occupant shall be provided on each side of the horizontal exit for the total number of people in adjoining compartments.

Every fire compartment for which credit is allowed in connection with a horizontal exit shall not be required to have a stairway or door leading directly outside, provided the adjoining fire compartments have stairways or doors leading directly outside and are so arranged that egress shall not require the occupants to return through the compartment from which egress originates.

The area into which a horizontal exit leads shall be provided with exits adequate to meet the occupant requirements of 780 CMR 10.00, but not including the added occupant capacity imposed by persons entering it through horizontal exits from another area. At least one of its exits shall lead directly to the exterior or to an exit enclosure.

1021.2 Separation. The separation between buildings or areas of refuge connected by a horizontal exit shall be provided by a fire wall complying with 780 CMR 705.0 or a fire barrier complying with 780 CMR 706.0 and having a fire-resistance rating of not less than two hours. Opening protectives in horizontal exit walls shall also comply with 780 CMR 715.0. The horizontal exit separation shall extend vertically through all levels of the building unless floor assemblies are of two-hour fire resistance with no unprotected openings.

Exception. A fire-resistance rating is not required at horizontal exits between a building area and an above-grade pedestrian walkway constructed in accordance with 780 CMR 3104.0, provided that the distance between connected buildings is more than 20 feet (6096 mm).

Horizontal exit walls constructed as fire barriers shall be continuous from exterior wall to exterior wall so as to divide completely the floor served by the horizontal exit.

1021.3 Opening Protectives. Fire doors in horizontal exits shall be self-closing or automatic-closing when activated by a smoke detector installed in accordance with 780 CMR 907.10. Opening protectives in horizontal exits shall be consistent with the fire-resistance rating of the wall. Such doors where located in a cross-corridor condition shall be automatic-closing by activation of a smoke detector installed in accordance with 780 CMR 907.10.

1021.4 Capacity of Refuge Area. The refuge area of a horizontal exit shall be spaces occupied by the same tenant or public areas and each such area of refuge shall be adequate to house the original occupant load of the refuge space plus the occupant load anticipated from the adjoining compartment. The anticipated occupant load from the adjoining compartment shall be based on the capacity of the horizontal exit doors entering the area of refuge. The capacity of areas of refuge shall be computed on a net floor area allowance of three square feet (0.2787 m^2) for each occupant to be accommodated therein, not including areas of stairways, elevators and other shafts or courts.

Exception: The net floor area allowable per occupant shall be as follows for the indicated occupancies:

1. Six square feet (0.6 m^2) per occupant for occupancies in Group I-3.
2. 15 square feet (1.4 m^2) per occupant for ambulatory occupancies in Group I-2.
3. 30 square feet (2.8 m^2) per occupant for nonambulatory occupancies in Group I-2.

780 CMR 1022.0 EXTERIOR EXIT RAMPS AND STAIRWAYS

1022.1 Exterior Exit Ramps and Stairways. ***For A-2 nightclubs (A-2nc) also see 780 CMR 1024.*** Exterior exit ramps and stairways serving as an element of a required means of egress shall comply with 780 CMR 1022.0.

Exception. Exterior exit ramps and stairways for outdoor stadiums complying with 780 CMR 1019.1, Exception 2.

1022.2 Use in a Means of Egress. Exterior exit ramps and stairways shall not be used as an element of a required means of egress for occupancies in Group I-2. For occupancies in other than Group I-2, exterior exit ramps and stairways shall be permitted as an element of a required means of egress for buildings not exceeding six stories or 75 feet (22 860 mm) in height.

1022.3 Open Side. Exterior exit ramps and stairways serving as an element of a required means of egress shall be open on at least one side. An open side shall have a minimum of 35 square feet (3.3 m^2) of aggregate open area adjacent to each floor level and the level of each intermediate landing. The required open area shall be located not less than 42 inches (1067 mm) above the adjacent floor or landing level.

1022.4 Side Yards. The open areas adjoining exterior exit ramps or stairways shall be either yards, courts or public ways; the remaining sides are permitted to be enclosed by the exterior walls of the building.

1022.5 Location. Exterior exit ramps and stairways shall be located in accordance with 780 CMR 1023.3.

1022.6 Exterior Ramps and Stairway Protection. Exterior exit ramps and stairways shall be separated from the interior of the building as required in 780 CMR 1019.1. Openings shall be limited to those necessary for egress from normally occupied spaces.

Exceptions:

1. Separation from the interior of the building is not required for occupancies, other than those in Group R-1 or R-2, in buildings that are no more than two stories above grade where the level of exit discharge is the first story above grade.
2. Separation from the interior of the building is not required where the exterior ramp or stairway is served by an exterior ramp and/or balcony that connects two remote exterior stairways or other approved exits, with a perimeter that is not less than 50% open. To be considered open, the opening shall be a minimum of 50% of the height of the enclosing wall, with the top of the openings no less than seven feet (2134 mm) above the top of the balcony.
3. Separation from the interior of the building is not required for an exterior ramp or stairway located in a building or structure that is permitted to have unenclosed interior stairways in accordance with 780 CMR 1019.1.
4. Separation from the interior of the building is not required for exterior ramps or stairways connected to open-ended corridors, provided that 780 CMR 1022.6, Exceptions 4.1 through 4.4 are met:
    - 4.1. The building, including corridors and ramps and/or stairs, shall be equipped throughout with an automatic sprinkler system in accordance with 780 CMR 903.3.1.1 or 903.3.1.2.
    - 4.2. The open-ended corridors comply with 780 CMR 1016.
    - 4.3. The open-ended corridors are connected on each end to an exterior exit ramp or stairway complying with 780 CMR 1022.
    - 4.4. At any location in an open-ended corridor where a change of direction exceeding 45 degrees (0.79 rad) occurs, a clear opening of not less than 35 square feet (3.3 m^2) or an exterior ramp or stairway shall be provided. Where clear openings are provided, they shall be located so as to minimize the accumulation of smoke or toxic gases.

780 CMR 1023.0 EXIT DISCHARGE

1023.1 General. ***For A-2 nightclubs (A-2nc) also see 780 CMR 1024.*** Exits shall discharge directly to the exterior of the building. The exit discharge shall be at grade or shall provide direct access to grade. The exit discharge shall not reenter a building.

Exceptions:

1. A maximum of 50% of the number and capacity of the exit enclosures is permitted to egress through areas on the level of discharge provided all of the 780 CMR 1023.1, Exceptions 1.1 through 1.3 are met:
    - 1.1. Such exit enclosures egress to a free and unobstructed way to the exterior of the building, which way is readily visible and identifiable from the point of termination of the exit enclosure.
    - 1.2. The entire area of the level of discharge is separated from areas below by construction conforming to the fire-resistance rating for the exit enclosure.
    - 1.3. The egress path from the exit enclosure on the level of discharge is protected throughout by an approved automatic sprinkler system. All portions of the level of discharge with access to the egress path shall either be protected throughout with an automatic sprinkler system installed in accordance with 780 CMR 903.3.1.1 or 903.3.1.2, or separated from the egress path in accordance with the requirements for the enclosure of exits.
2. A maximum of 50% of the number and capacity of the exit enclosures is permitted to egress through a vestibule provided all of 780 CMR 1023.1, Exceptions 2.1 through 2.4 are met:
    - 2.1. The entire area of the vestibule is separated from areas below by construction conforming to the fire-resistance rating for the exit enclosure.
    - 2.2. The depth from the exterior of the building is not greater than ten feet (3048 mm) and the length is not greater than 30 feet (9144 mm).
    - 2.3. The area is separated from the remainder of the level of exit discharge by construction providing protection at least the equivalent of approved wired glass in steel frames.
    - 2.4. The area is used only for means of egress and exits directly to the outside.
3. Stairways in open parking garages complying with 780 CMR 1019.1, Exception 5, are permitted to egress through the open parking garage at the level of exit discharge.

1023.2 Exit Discharge Capacity. The capacity of the exit discharge shall be not less than the required discharge capacity of the exits being served.

1023.3 Exit Discharge Location. Exterior balconies, stairways and ramps shall be located at least ten feet (3048 mm) from adjacent lot lines and from other buildings on the same lot unless the adjacent building exterior walls and openings are protected in accordance with 780 CMR 704 based on fire separation distance.

1023.4 Exit Discharge Components. Exit discharge components shall be sufficiently open to the exterior so as to minimize the accumulation of smoke and toxic gases.

1023.5 Egress Courts. Egress courts serving as a portion of the exit discharge in the means of egress system shall comply with the requirements of 780 CMR 1023.

1023.5.1 Width. The width of egress courts shall be determined as specified in 780 CMR 1005.1, but such width shall not be less than 44 inches (1118 mm), except as specified herein. Egress courts serving occupancies in Group R-3 applicable in 780 CMR 101.2 and Group U shall not be less than 36 inches (914 mm) in width.

The required width of egress courts shall be unobstructed to a height of seven feet (2134 mm).

Exception. Doors, when fully opened, and handrails shall not reduce the required width by more than seven inches (178 mm). Doors in any position shall not reduce the required width by more than one-half. Other nonstructural projections such as trim and similar decorative features are permitted to project into the required width 1½ inches (38 mm) from each side.

Where an egress court exceeds the minimum required width and the width of such egress court is then reduced along the path of exit travel, the reduction in width shall be gradual. The transition in width shall be affected by a guard not less than 36 inches (914 mm) in height and shall not create an angle of more than 30 degrees (0.52 rad) with respect to the axis of the egress court along the path of egress travel. In no case shall the width of the egress court be less than the required minimum.

1023.5.2 Construction and Openings. Where an egress court serving a building or portion thereof is less than ten feet (3048 mm) in width, the egress court walls shall be not less than one-hour fire-resistance-rated exterior walls complying with 780 CMR 704 for a distance of ten feet (3048 mm) above the floor of the court, and openings therein shall be equipped with fixed or self-closing, ¾-hour opening protective assemblies.

Exceptions:

1. Egress courts serving an occupant load of less than ten.
2. Egress courts serving Group R-3 as applicable in 780 CMR 101.2.

1023.6 Access to a Public Way. The exit discharge shall provide a direct and unobstructed access to a public way.

Exception. Where access to a public way cannot be provided, a safe dispersal area shall be provided where all of the following are met:

1. The area shall be of a size to accommodate at least five square feet ($0.28\ m^2$) for each person.
2. The area shall be located on the same property at least 50 feet (15 240 mm) away from the building requiring egress.
3. The area shall be permanently maintained and identified as a safe dispersal area.
4. The area shall be provided with a safe and unobstructed path of travel from the building.

780 CMR 1024.0 ASSEMBLY

1024.1 General. Occupancies in Group A which contain seats, tables, displays, equipment or other material shall comply with 780 CMR 1024.0.

1024.1.1 Night Clubs (A-2nc) Required Means of Egress Requirements. For buildings or portions thereof that are classified as A-2nc use and which have an occupant load of 50 or greater, the main entrance egress system shall be sized such that the width of all required means of egress elements is 72 inches (nominal) or otherwise such main entrance egress system shall be sized in accordance with the applicable portions of 780 CMR 10.00, whichever criteria results in the larger required means of egress system but in no case shall the main entrance egress system be less than 72 inches in nominal width, including the main entrance/exit door system and the main entrance/ exit door system shall consist of a pair of side-hinged swinging type doors without a center mullion and shall be equipped with panic hardware.

1024.1.2 **Bleachers**. Bleachers, grandstands, and folding and telescopic seating shall comply with ICC 300.

1024.2 Assembly Main Exit. Group A occupancies that have an occupant load of greater than 300 shall be provided with a main exit. The main exit shall be of sufficient width to accommodate not less than one-half of the occupant load, but such width shall not be less than the total required width of all means of egress leading to the exit. Where the building is classified as a Group A occupancy, the main exit shall front on at least one street or an unoccupied space of not less than ten feet (3048 mm) in width that adjoins a street or public way.

Exception. In assembly occupancies where there is no well-defined main exit or where multiple main exits are provided, exits shall be permitted to be distributed around the perimeter of the building provided that the total width of egress is not less than 100% of the required width.

1024.3 Assembly Other Exits. In addition to having access to a main exit, each level of an occupancy in Group A having an occupant load of greater than 300 shall be provided with additional exits that shall provide an egress capacity for at least one-half of the total occupant load served by that level and comply with 780 CMR 1014.2.

Exception. In assembly occupancies where there is no well-defined main exit or where multiple main exits are provided, exits shall be permitted to be distributed around the perimeter of the building provided that the total width of egress is not less than 100% of the required width.

1024.4 Foyers and Lobbies. In Group A-1 occupancies, where persons are admitted to the building at times when seats are not available and are allowed to wait in a lobby or similar space, such use of lobby or similar space shall not encroach upon the required clear width of the means of egress. Such waiting areas shall be separated from the required means of egress by substantial permanent partitions or by fixed rigid railings not less than 42 inches (1067 mm) high. Such foyer, if not directly connected to a public street by all the main entrances or exits, shall have a straight and unobstructed corridor or path of travel to every such main entrance or exit.

1024.5 Interior Balcony and Gallery Means of Egress. For balconies or galleries having a seating capacity of over 50 located in Group A occupancies, at least two means of egress shall be provided, one from each side of every balcony or gallery, with at least one leading directly to an exit.

1024.5.1 Enclosure of Balcony Openings. Interior stairways and other vertical openings shall be enclosed in a vertical exit enclosure as provided in 780 CMR 1019.1, except that stairways are permitted to be open between the balcony and the main assembly floor in occupancies such as theaters, churches and auditoriums. At least one accessible means of egress is required from a balcony or gallery level containing accessible seating locations in accordance with 780 CMR 1007.3 or 1007.4.

1024.6 Width of means of egress for assembly. The clear width of aisles and other means of egress shall comply with 780 CMR 1024.6.1 where smoke-protected seating is not provided and with 780 CMR 1024.6.2 or 1024.6.3 where smoke-protected seating is provided. The clear width shall be measured to walls, edges of seating and tread edges except for permitted projections.

1024.6.1 Without Smoke Protection. The clear width of the means of egress shall provide sufficient capacity in accordance with all of the following, as applicable:

1. At least 0.3 inch (7.6 mm) of width for each occupant served shall be provided on stairs having riser heights seven inches (178 mm) or less and tread depths 11 inches (279 mm) or greater, measured horizontally between tread nosing.
2. At least 0.005 inch (0.127 mm) of additional stair width for each occupant shall be provided for each 0.10 inch (2.5 mm) of riser height above seven inches (178 mm).
3. Where egress requires stair descent, at least 0.075 inch (1.9 mm) of additional width for each occupant shall be provided on those portions of stair width having no handrail within a horizontal distance of 30 inches (762 mm).
4. Ramped means of egress, where slopes are steeper than one unit vertical in 12 units horizontal (8% slope), shall have at least 0.22 inch (5.6 mm) of clear width for each occupant served. Level or ramped means of egress, where slopes are not steeper than one unit vertical in 12 units horizontal (8% slope), shall have at least 0.20 inch (5.1 mm) of clear width for each occupant served.

1024.6.2 Smoke-protected Seating. The clear width of the means of egress for smoke-protected assembly seating shall be not less than the occupant load served by the egress element multiplied by the appropriate factor in Table 1024.6.2. The total number of seats specified shall be those within a single assembly space and exposed to the same smoke-protected environment. Interpolation is permitted between the specific values shown. A life safety evaluation, complying with NFPA 101, shall be done for a facility utilizing the reduced width requirements of Table 1024.6.2 for smoke-protected assembly seating.

Exception. For an outdoor smoke-protected assembly with an occupant load not greater than 18,000, the clear width shall be determined using the factors in 780 CMR 1024.6.3.

TABLE 1024.6.2 WIDTH OF AISLES FOR SMOKE-PROTECTED ASSEMBLY

TOTAL NUMBER OF SEATS IN THE SMOKE-PROTECTED ASSEMBLY OCCUPANCY	INCHES OF CLEAR WIDTH PER SEAT SERVED			
	Stairs and aisle steps with handrails within 30 inches	Stairs and aisle steps without handrails within 30 inches	Passageways, doorways and ramps not steeper than one in ten in slope	Ramps steeper than one in ten in slope
Equal to or less than 5,000	0.2	0.25	0.15	0.165
10000	0.13	0.163	0.1	0.11
15000	0.096	0.12	0.07	0.077
20000	0.076	0.095	0.056	0.062
Equal to or greater than 25,000	0.06	0 075	0 044	0.048

For SI: 1 inch - 25.4 mm.

1024.6.2.1 Smoke Control. Means of egress serving a smoke-protected assembly seating area shall be provided with a smoke control system complying with 780 CMR 909.0 or natural ventilation designed to maintain the smoke level at least six feet (1829 mm) above the floor of the means of egress.

1024.6.2.2 Roof Height. A smoke-protected assembly seating area with a roof shall have the lowest portion of the roof deck not less than 15 feet (4572 mm) above the highest aisle or aisle accessway.

Exception. A roof canopy in an outdoor stadium shall be permitted to be less than 15 feet (4572 mm) above the highest aisle or aisle accessway provided that there are no objects less than 80 inches (2032 mm) above the highest aisle or aisle accessway.

1024.6.2.3 Automatic Sprinklers. Enclosed areas with walls and ceilings in buildings or structures containing smoke-protected assembly seating shall be protected with an approved automatic sprinkler system in accordance with 780 CMR 903.3.1.1.

Exceptions:

1. The floor area used for contests, performances or entertainment provided the roof construction is more than 50 feet (15 240 mm) above the floor level and the use is restricted to low fire hazard uses.
2. Press boxes and storage facilities less than 1,000 square feet (93 m^2) in area.
3. Outdoor seating facilities where seating and the means of egress in the seating area are essentially open to the outside.

1024.6.3 Width of Means of Egress for Outdoor Smoke-protected Assembly. The clear width in inches (mm) of aisles and other means of egress shall be not less than the total occupant load served by the egress element multiplied by 0.08 (2.0 mm) where egress is by aisles and stairs and multiplied by 0.06 (1.52 mm) where egress is by ramps, corridors, tunnels or vomitories.

Exception. The clear width in inches (mm) of aisles and other means of egress shall be permitted to comply with 780 CMR 1024.6.2 for the number of seats in the outdoor smoke-protected assembly where 780 CMR 1024.6.2 permits less width.

1024.7 Travel Distance. Exits and aisles shall be so located that the travel distance to an exit door shall not be greater than 200 feet (60 960 mm) measured along the line of travel in nonsprinklered buildings. Travel distance shall not be more than 250 feet (76 200 mm) in sprinklered buildings. Where aisles are provided for seating, the distance shall be measured along the aisles and aisle accessway without travel over or on the seats.

Exceptions:

1. Smoke-protected assembly seating: The travel distance from each seat to the nearest entrance to a vomitory or concourse shall not exceed 200 feet (60 960 mm). The travel distance from the entrance to the vomitory or concourse to a stair, ramp or walk on the exterior of the building shall not exceed 200 feet (60 960 mm).
2. Open-air seating: The travel distance from each seat to the building exterior shall not exceed 400 feet (122 m). The travel distance shall not be limited in facilities of Type I or II construction.

1024.8 Common Path of Travel. The common path of travel shall not exceed 30 feet (9144 mm) from any seat to a point where a person has a choice of two paths of egress travel to two exits.

Exceptions:

1. For areas serving not more than 50 occupants, the common path of travel shall not exceed 75 feet (22 860 mm).
2. For smoke-protected assembly seating, the common path of travel shall not exceed 50 feet (15 240 mm).

1024.8.1 Path Through Adjacent Row. Where one of the two paths of travel is across the aisle through a row of seats to another aisle, there shall be not more than 24 seats between the two aisles, and the minimum clear width between rows for the row between the two aisles shall be 12 inches (305 mm) plus 0.6 inch (15.2 mm) for each additional seat above seven in the row between aisles.

Exception. For smoke-protected assembly seating there shall not be more than 40 seats between the two aisles and the minimum clear width shall be 12 inches (305 mm) plus 0.3 inch (7.6 mm) for each additional seat.

1024.9 Assembly Aisles Are Required. Every occupied portion of any occupancy in Group A that contains seats, tables, displays, similar fixtures or equipment shall be provided with aisles leading to exits or exit access doorways in accordance with 780 CMR 1024.9. Aisle accessways for tables and seating shall comply with 780 CMR 1013.4.2.

1024.9.1 Minimum Aisle Width. The minimum clear width of aisles shall be as shown:

1. 48 inches (1219 mm) for aisle stairs having seating on each side.

   Exception. 36 inches (914 mm) where the aisle does not serve more than 50 seats.

2. 36 inches (914 mm) for aisle stairs having seating on only one side.
3. 23 inches (584 mm) between an aisle stair handrail or guard and seating where the aisle is subdivided by a handrail.
4. 42 inches (1067 mm) for level or ramped aisles having seating on both sides.

   Exceptions:
   1. 36 inches (914 mm) where the aisle does not serve more than 50 seats.
   2. 36 inches (762 mm) where the aisle does not serve more than 14 seats.

5. 36 inches (914 mm) for level or ramped aisles having seating on only one side.

   Exception. 30 inches (762 mm) where the aisle does not serve more than 14 seats.

6. 23 inches (584 mm) between an aisle stair handrail and seating where an aisle does not serve more than five rows on one side.

1024.9.2 Aisle Width. The aisle width shall provide sufficient egress capacity for the number of persons accommodated by the catchment area served by the aisle. The catchment area served by an aisle is that portion of the total space that is served by that section of the aisle. In establishing catchment areas, the assumption shall be made that there is a balanced use of all means of egress, with the number of persons in proportion to egress capacity.

1024.9.3 Converging Aisles. Where aisles converge to form a single path of egress travel, the required egress capacity of that path shall not be less than the combined required capacity of the converging aisles.

1024.9.4 Uniform width. Those portions of aisles, where egress is possible in either of two directions, shall be uniform in required width.

1024.9.5 Assembly Aisle Termination. Each end of an aisle shall terminate at cross aisle, foyer, doorway, vomitory or concourse having access to an exit.

Exceptions:
1. Dead-end aisles shall not be greater than 20 feet (6096 mm) in length.
2. Dead-end aisles longer than 20 feet (6096 mm) are permitted where seats beyond the 20-foot (6096 mm) dead-end aisle are no more than 24 seats from another aisle, measured along a row of seats having a minimum clear width of 12 inches (305 mm) plus 0.6 inch (15.2 mm) for each additional seat above seven in the row.
3. For smoke-protected assembly seating, the dead-end aisle length of vertical aisles shall not exceed a distance of 21 rows.
4. For smoke-protected assembly seating, a longer dead-end aisle is permitted where seats beyond the 21-row dead-end aisle are not more than 40 seats from another aisle, measured along a row of seats having an aisle accessway with a minimum clear width of 12 inches (305 mm) plus 0.3 inch (7.6 mm) for each additional seat above seven in the row.

1024.9.6 Assembly Aisle Obstructions. There shall be no obstructions in the required width of aisles except for handrails as provided in 780 CMR 1024.13.

1024.10 Clear Width of Aisle Accessways Serving Seating. Where seating rows have 14 or fewer seats, the minimum clear aisle accessway width shall not be less than 12 inches (305 mm) measured as the clear horizontal distance from the back of the row ahead and the nearest projection of the row behind. Where chairs have automatic or self-rising seats, the measurement shall be made with seats in the raised position. Where any chair in the row does not have an automatic or self-rising seat, the measurements shall be made with the seat in the down position. For seats with folding tablet arms, row spacing shall be determined with the tablet arm down.

1024.10.1 Dual Access. For rows of seating served by aisles or doorways at both ends, there shall not be more than 100 seats per row. The minimum clear width of 12 inches (305 mm) between rows shall be increased by 0.3 inch (7.6 mm) for every additional seat beyond 14 seats, but the minimum clear width is not required to exceed 22 inches (559 mm).

Exception. For smoke-protected assembly seating, the row length limits for a 12-inch-wide (305 mm) aisle accessway, beyond which the aisle accessway minimum clear width shall be increased, are in Table 1024.10.1.

TABLE 1024.10.1 SMOKE-PROTECTED ASSEMBLY AISLE ACCESSWAYS

TOTAL NUMBER OF SEATS IN THE SMOKE-PROTECTED ASSEMBLY OCCUPANCY	MAXIMUM NUMBER OF SEATS PER ROW PERMITTED TO HAVE A MINIMUM 12-INCH CLEAR WIDTH AISLE ACCESSWAY	
	Aisle or doorway at both ends of row	Aisle or doorway at one end of row only
Less than 4,000	14	7
4000	15	7
7000	16	8
10000	17	8
13000	18	9
16000	19	9
19000	20	10
22,000 and greater	21	11

1024.10.2 Single Access. For rows of seating served by an aisle or doorway at only one end of the row, the minimum clear width of 12 inches (305 mm) between rows shall be increased by 0.6 inch (15.2 mm) for every additional seat beyond seven seats, but the minimum clear width is not required to exceed 22 inches (559 mm).

Exception. For smoke-protected assembly seating, the row length limits for a 12-inch-wide (305 mm) aisle accessway, beyond which the aisle accessway minimum clear width shall be increased, are in Table 1024.10.1.

1024.11 Assembly Aisle Walking Surfaces. Aisles with a slope not exceeding one unit vertical in eight units horizontal (12.5% slope) shall consist of a ramp having a slip-resistant walking surface. Aisles with a slope exceeding one unit vertical in eight units horizontal (12.5% slope) shall consist of a series of risers and treads that extends across the full width of aisles and complies with 780 CMR 1024.11.1 through 1024.11.3.

1024.11.1 Treads. Tread depths shall be a minimum of 11 inches (279 mm) and shall have dimensional uniformity.

Exception. The tolerance between adjacent treads shall not exceed 0.188 inch (4.8 mm).

1024.11.2 Risers. Where the gradient of aisle stairs is to be the same as the gradient of adjoining seating areas, the riser height shall not be less than four inches (102 mm) nor more than eight inches (203 mm) and shall be uniform within each flight.

Exceptions:

1. Riser height nonuniformity shall be limited to the extent necessitated by changes in the gradient of the adjoining seating area to maintain adequate sightlines. Where nonuniformities exceed 0.188 inch (4.8 mm) between adjacent risers, the exact location of such nonuniformities shall be indicated with a distinctive marking stripe on each tread at the nosing or leading edge adjacent to the nonuniform risers. Such stripe shall be a minimum of one inch (25 mm), and a maximum of two inches (51 mm), wide. The edge marking stripe shall be distinctively different from the contrasting marking stripe.
2. Riser heights not exceeding nine inches (229 mm) shall be permitted where they are necessitated by the slope of the adjacent seating areas to maintain sightlines.

1024.11.3 Tread Contrasting Marking Stripe. A contrasting marking stripe shall be provided on each tread at the nosing or leading edge such that the location of each tread is readily apparent when viewed in descent. Such stripe shall be a minimum of one inch (25 mm), and a maximum of two inches (51 mm), wide.

Exception. The contrasting marking stripe is permitted to be omitted where tread surfaces are such that the location of each tread is readily apparent when viewed in descent.

1024.12 Seat Stability. In places of assembly, the seats shall be securely fastened to the floor.

Exceptions:

1. In places of assembly or portions thereof without ramped or tiered floors for seating and with 200 or fewer seats, the seats shall not be required to be fastened to the floor.
2. In places of assembly or portions thereof with seating at tables and without ramped or tiered floors for seating, the seats shall not be required to be fastened to the floor.
3. In places of assembly or portions thereof without ramped or tiered floors for seating and with greater than 200 seats, the seats shall be fastened together in groups of not less than three or the seats shall be securely fastened to the floor.
4. In places of assembly where flexibility of the seating arrangement is an integral part of the design and function of the space and seating is on tiered levels, a maximum of 200 seats shall not be required to be fastened to the floor. Plans showing seating, tiers and aisles shall be submitted for approval.
5. Groups of seats within a place of assembly separated from other seating by railings, guards, partial height walls or similar barriers with level floors and having no more than 14 seats per group shall not be required to be fastened to the floor.
6. Seats intended for musicians or other performers and separated by railings, guards, partial height walls or similar barriers shall not be required to be fastened to the floor.

1024.13 Handrails. Ramped aisles having a slope exceeding one unit vertical in 15 units horizontal (6.7% slope) and aisle stairs shall be provided with handrails located either at the side or within the aisle width.

Exceptions:

1. Handrails are not required for ramped aisles having a gradient no greater than one unit vertical in eight units horizontal (12.5% slope) and seating on both sides.
2. Handrails are not required if, at the side of the aisle, there is a guard that complies with the graspability requirements of handrails.

1024.13.1 Discontinuous Handrails. Where there is seating on both sides of the aisle, the handrails shall be discontinuous with gaps or breaks at intervals not exceeding five rows to facilitate access to seating and to permit crossing from one side of the aisle to the other. These gaps or breaks shall have a clear width of at least 22 inches (559 mm) and not greater than 36 inches (914 mm), measured horizontally, and the handrail shall have rounded terminations or bends.

1024.13.2 Intermediate Handrails. Where handrails are provided in the middle of aisle stairs, there shall be an additional intermediate handrail located approximately 12 inches (305 mm) below the main handrail.

1024.14 Assembly Guards. Assembly guards shall comply with 780 CMR 1024.14.1 through 1024.14.3.

1024.14.1 Cross Aisles. Cross aisles located more than 30 inches (762 mm) above the floor or grade below shall have guards in accordance with 780 CMR 1012.

Where an elevation change of 30 inches (762 mm) or less occurs between a cross aisle and the adjacent floor or grade below, guards not less than 26 inches (660 mm) above the aisle floor shall be provided.

Exception. Where the backs of seats on the front of the cross aisle project 24 inches (610 mm) or more above the adjacent floor of the aisle, a guard need not be provided.

1024.14.2 Sightline-constrained Guard Heights. Unless subject to the requirements of 780 CMR 1024.14.3, a fascia or railing system in accordance with the guard requirements of 780 CMR 1012.0 and having a minimum height of 26 inches (660 mm) shall be provided where the floor or footboard elevation is more than 30 inches (762 mm) above the floor or grade below and the fascia or railing would otherwise interfere with the sightlines of immediately adjacent seating. At bleachers, a guard must be provided where the floor or footboard elevation is more than 24 inches (610 mm) above the floor or grade below and the fascia or railing would otherwise interfere with the sightlines of the immediately adjacent seating.

1024.14.3 Guards at the End of Aisles. A fascia or railing system complying with the guard requirements of 780 CMR 1012.0 shall be provided for the full width of the aisle where the foot of the aisle is more than 30 inches (762 mm) above the floor or grade below. The fascia or railing shall be a minimum of 36 inches (914 mm) high and shall provide a minimum 42 inches (1067 mm) measured diagonally between the top of the rail and the nosing of the nearest tread.

1024.15 Bench Seating. Where bench seating is used, the number of persons shall be based on one person for each 18 inches (457 mm) of length of the bench.

780 CMR 1025.0 EMERGENCY ESCAPE AND RESCUE

1025.1 General. In addition to the means of egress required by 780 CMR 10.00, provisions shall be made for emergency escape and rescue in Group R as applicable in 780 CMR 101.2 and Group I-1 occupancies. Basements and sleeping rooms below the fourth story above grade plane shall have at least one exterior emergency escape and rescue opening in accordance with 780 CMR 1025.0. Where basements contain one or more sleeping rooms, emergency egress and rescue openings shall be required in each sleeping room, but shall not be required in adjoining areas of the basement. Such opening shall open directly into a public street, public alley, yard or court.

Exceptions:

1. In other than Group R-3 occupancies as applicable in 780 CMR 101.2, buildings equipped throughout with an approved automatic sprinkler system in accordance with 780 CMR 903.3.1.1 or 903.3.1.2.
2. In other than Group R-3 occupancies as applicable in 780 CMR 101.2, sleeping rooms provided with a door to a fire-resistance-rated corridor having access to two remote exits in opposite directions.
3. The emergency escape and rescue opening is permitted to open onto a balcony within an atrium in accordance with the requirements of 780 CMR 404.0, provided the balcony provides access to an exit and the dwelling unit or sleeping unit has a means of egress that is not open to the atrium.
4. Basements with a ceiling height of less than 80 inches (2032 mm) shall not be required to have emergency escape and rescue windows.
5. High-rise buildings in accordance with 780 CMR 403.
6. Emergency escape and rescue openings are not required from basements or sleeping rooms which have an exit door or exit access door that opens directly into a public street, public alley, yard,

egress court or to an exterior exit balcony that opens to a public street, public alley, yard or egress court.

7. Basements without habitable spaces and having no more than 200 square feet (18.6 square meters) in floor area shall not be required to have emergency escape windows.

1025.2 Minimum Size. Emergency escape and rescue openings shall have a minimum net clear opening of 5.7 square feet (0.53 m^2).

Exception. The minimum net clear opening for emergency escape and rescue grade-floor openings shall be five square feet (0.46 m^2).

1025.2.1 Minimum Dimensions. The minimum net clear opening height dimension shall be 24 inches (610 mm). The minimum net clear opening width dimension shall be 20 inches (508 mm). The net clear opening dimensions shall be the result of normal operation of the opening.

1025.3 Maximum Height from Floor. Emergency escape and rescue openings shall have the bottom of the clear opening not greater than 44 inches (1118 mm) measured from the floor.

1025.4 Operational Constraints. Emergency escape and rescue openings shall be operational from the inside of the room without the use of keys or tools. Bars, grilles, grates or similar devices are permitted to be placed over emergency escape and rescue openings provided the minimum net clear opening size complies with 780 CMR 1025.2 and such devices shall be releasable or removable from the inside without the use of a key, tool or force greater than that which is required for normal operation of the escape and rescue opening. Where such bars, grilles, grates or similar devices are installed in existing buildings, smoke alarms shall be installed in accordance with 780 CMR 907.2.10 regardless of the valuation of the alteration.

1025.5 Window Wells. An emergency escape and rescue opening with a finished sill height below the adjacent ground level shall be provided with a window well in accordance with 780 CMR 1025.5.1 and 1025.5.2.

1025.5.1 Minimum Size. The minimum horizontal area of the window well shall be 9 square feet (0.84 m^2), with a minimum dimension of 36 inches (914 mm). The area of the window well shall allow the emergency escape and rescue opening to be fully opened.

1025.5.2 Ladders or Steps. Window wells with a vertical depth of more than 44 inches (1118 mm) shall be equipped with an approved permanently affixed ladder or steps. Ladders or rungs shall have an inside width of at least 12 inches (305 mm), shall project at least three inches (76 mm) from the wall and shall be spaced not more than 18 inches (457 mm) on center (o.c.) vertically for the full height of the window well. The ladder or steps shall not encroach into the required dimensions of the window well by more than six inches (152 mm). The ladder or steps shall not be obstructed by the emergency escape and rescue opening. Ladders or steps required by 780 CMR 1025.5 are exempt from the stairway requirements of 780 CMR 1009.

780 CMR 11.00

ACCESSABILITY

780 CMR 1101.0 JURISDICTION

1101.1 Architectural Access Board Regulations. M.G.L. c.22 § 13A provides that all public buildings shall be designed to be accessible to, functional for and safe for the use by physically handicapped persons, in conformance with the Massachusetts Architectural Access Board's Regulations (521 CMR 1.00 et seq.) listed in Appendix A and promulgated by the Architectural Access Board.

1101.2 Enforcement of 521 CMR. In accordance with M.G.L. c.143 § 3 and 780 CMR 106.1, 521 CMR 1.00 et sec. shall be enforced by the municipal building code enforcement official or state inspector, as applicable.

NON-TEXT PAGE

780 CMR 12.00

INTERIOR ENVIRONMENT

780 CMR 1201.0 GENERAL

1201.1 Scope. The provisions of 780 CMR 12.00 shall govern ventilation, temperature control, lighting, yards and courts, sound transmission, room dimensions, surrounding materials and rodent proofing associated with the interior spaces of buildings.

780 CMR 1202.0 DEFINITIONS

1202.1 General. The following words and terms shall, for the purposes of 780 CMR 12.00 and as used elsewhere in 780 CMR, have the meanings shown in 780 CMR 1202.1.

SUNROOM ADDITION. A one-story addition added to an existing building with a glazing area in excess of 40% of the gross area of the structure's exterior walls and roof.

THERMAL ISOLATION. A separation of conditioned spaces, between a sunroom addition and a dwelling unit, consisting of existing or new wall(s), doors and/or windows.

780 CMR 1203.0 VENTILATION

1203.1 General. Buildings shall be provided with natural ventilation in accordance with 780 CMR 1203.4, or mechanical ventilation in accordance with the *International Mechanical Code*.

> ***Exception. Every bathroom containing a bathtub and/or shower shall be equipped with a mechanical exhaust fan and associated ductwork with the fan exhausting, at such rates as specified in the ICC International Mechanical Code, Chapter 4 as referenced in 780 CMR 100.00. Passive ventilation methods such as openable windows shall not substitute for mechanical ventilation required in 780 CMR 12.00. Such bathroom exhaust shall vent directly to the outside and no exhaust vent shall terminate in attics or other interior portions of the building.***

1203.2 Attic Spaces. Enclosed attics and enclosed rafter spaces formed where ceilings are applied directly to the underside of roof framing members shall have cross ventilation for each separate space by ventilating openings protected against the entrance of rain and snow. Blocking and bridging shall be arranged so as not to interfere with the movement of air. A minimum of one inch (25 mm) of airspace shall be provided between the insulation and the roof sheathing. The net free ventilating area shall not be less than 1/150 of the area of the space ventilated, with 50% of the required ventilating area provided by ventilators located in the upper portion of the space to be ventilated at least three feet (914 mm) above eave or cornice vents with the balance of the required ventilation provided by eave or cornice vents.

Exceptions:

1. The minimum required net free ventilating area shall be $^1/_{300}$ of the area of the space ventilated, provided a vapor retarder having a transmission rate not exceeding one perm in accordance with ASTM E 96 is installed on the warm side of the attic insulation and provided 50% of the required ventilating area provided by ventilators located in the upper portion of the space to be ventilated at least three feet (914 mm) above eave or cornice vents, with the balance of the required ventilation provided by eave or cornice vents.
2. ***Roof assemblies where an expanding spray foam insulation material, providing at least 40% of the total R-value of the required insulation, is in direct contact with the underside of the roof deck and adjacent framing members. If the permeability of the foam material is less than two perm-inch, no vapor barrier is necessary.***
3. ***Roof assemblies where a board foam plastic insulation material, providing at least 40% of the total R-value of the required insulation, is placed on top of the roof deck. If the permeability of the foam material is less than two perm-inch, no vapor barrier is necessary.***

When either 780 CMR 1203.2, Exceptions 2. or 3. is taken, the following conditions must also be satisfied:

1. ***The roof assembly, including the wall-to-eave-to-roof deck connection must be made air-tight, per 780 CMR J4.3.3 or 780 CMR 1304.3 as applicable.***
2. ***Thermal barrier requirements, if any, shall be per 780 CMR 2603.4 as applicable.***
3. ***The roof assembly must meet the fireresistance rating requirements of 780 CMR, when and as applicable.***
4. ***Roofing material must be listed/warranted by its manufacturer for use in an unvented roof system.***

1203.2.1 Openings into Attic. Exterior openings into the attic space of any building intended for human occupancy shall be covered with corrosion-resistant wire cloth screening, hardware cloth, perforated vinyl or similar material that will prevent the entry of birds, squirrels, rodents, snakes and other similar creatures. The openings therein shall be a minimum of ⅛ inch (3.2 mm) and shall not exceed ¼ inch (6.4 mm). Where combustion air is obtained from an attic area, it shall be in accordance with the *International Mechanical Code*, Chapter 7 ***except that combustion air requirements for gas-fired appliances and oil-fired appliances shall conform to the requirements of the Specialized Codes, 248 CMR and 527 CMR respectively.***

1203.3 Under-floor Ventilation. The space between the bottom of the floor joists and the earth under any building except spaces occupied by a basement or cellar shall be provided with ventilation openings through foundation walls or exterior walls. Such openings shall be placed so as to provide cross ventilation of the under-floor space.

1203.3.1 Openings for Under-floor Ventilation. The minimum net area of ventilation openings shall not be less than one square foot for each 150 square feet (0.67 m^2 for each 100 m^2) of crawl-space area. Ventilation openings shall be covered for their height and width with any of the following materials, provided that the least dimension of the covering shall not exceed ¼ inch (6 mm):

1. Perforated sheet metal plates not less than 0.070 inch (1.8 mm) thick.
2. Expanded sheet metal plates not less than 0.047 inch (1.2 mm) thick.
3. Cast-iron grills or gratings.
4. Extruded load-bearing vents.
5. Hardware cloth of 0.035 inch (0.89 mm) wire or heavier.
6. Corrosion-resistant wire mesh, with the least dimension not exceeding ⅛ inch (3.2 mm).

1203.3.2 Exceptions. The following are exceptions to 780 CMR 1203.3 and 1203.3.1:

1. Where warranted by climatic conditions, ventilation openings to the outdoors are not required if ventilation openings to the interior are provided.
2. The total area of ventilation openings is permitted to be reduced to $^1/_{1,500}$ of the under-floor area where the ground surface is treated with an approved vapor retarder material and the required openings are placed so as to provide cross ventilation of the space. The installation of operable louvers shall not be prohibited.
3. Ventilation openings are not required where continuously operated mechanical ventilation is provided at a rate of 1.0 cubic foot per minute (cfm) for each 50 square feet (1.02 L/s for each 10 m^2) of crawl-space floor area and the ground surface is covered with an approved vapor retarder.
4. Ventilation openings are not required when the ground surface is covered with an approved vapor retarder, the perimeter walls are insulated and the space is conditioned in accordance with the *International Energy Conservation Code*.
5. For buildings in flood hazard areas as established in 780 CMR 120.G, the openings for under-floor ventilation shall be deemed as meeting the flood opening requirements of ASCE 24 provided that the ventilation openings are designed and installed in accordance with ASCE 24.

1203.4 Natural Ventilation. Natural ventilation of an occupied space shall be through windows, doors, louvers or other openings to the outdoors. The operating mechanism for such openings shall be provided with ready access so that the openings are readily controllable by the building occupants.

Exception. All occupancies shall have mechanical ventilation in bathrooms and toilet rooms as specified in 780 CMR 1203.1.

1203.4.1 Ventilation Area Required. The minimum openable area to the outdoors shall be 4% of the floor area being ventilated.

1203.4.1.1 Adjoining Spaces. Where rooms and spaces without openings to the outdoors are ventilated through an adjoining room, the opening to the adjoining room shall be unobstructed and shall have an area of not less than 8% of the floor area of the interior room or space, but not less than 25 square feet (2.3 m^2). The minimum openable area to the outdoors shall be based on the total floor area being ventilated.

Exception. Exterior openings required for ventilation shall be permitted to open into a thermally isolated sunroom addition or patio cover provided that the openable area between the sunroom addition or patio cover and the interior room shall have an area of not less than 8% of the floor area of the interior room or space, but not less than 20 square feet (1.86 m^2). The minimum openable area to the outdoors shall be based on the total floor area being ventilated.

1203.4.1.2 Openings below Grade. Where openings below grade provide required natural ventilation, the outside horizontal clear space measured perpendicular to the opening shall be 1½ times the depth of the opening. The depth of the opening shall be measured from the average adjoining ground level to the bottom of the opening.

1203.4.2 Contaminants Exhausted. Contaminant sources in naturally ventilated spaces shall be removed in accordance with the *International Mechanical Code* and the *International Fire Code.*

1203.4.2.1 Bathrooms. Rooms containing bathtubs, showers, spas and similar bathing fixtures shall be mechanically ventilated in accordance with the International Mechanical Code – see 780 CMR 1203.1.

1203.4.3 Openings on Yards or Courts. Where natural ventilation is to be provided by openings onto yards or courts, such yards or courts shall comply with 780 CMR 1206.0.

1203.5 Other Ventilation and Exhaust Systems. Ventilation and exhaust systems for occupancies and operations involving flammable or combustible hazards or other contaminant sources as covered in ***the ICC International Mechanical Code or the ICC International Fire Code shall be provided as required by both codes – Note that the ICC International Fire Code is not the Massachusetts State Fire Code but is referenced here narrow to ventilation requirements.***

780 CMR 1204.0 TEMPERATURE CONTROL

1204.1 Equipment and Systems. Interior spaces intended for human occupancy shall be provided with active or passive space-heating systems capable of maintaining a minimum indoor temperature of 68°F (20°C) at a point three feet (914 mm) above the floor on the design heating day.

Exception. Interior spaces where the primary purpose is not associated with human comfort.

780 CMR 1205.0 LIGHTING

1205.1 General. Every space intended for human occupancy shall be provided with natural light by means of exterior glazed openings in accordance with 780 CMR 1205.2 or shall be provided with artificial light in accordance with 780 CMR 1205.3. Exterior glazed openings shall open directly onto a public way or onto a yard or court in accordance with 780 CMR 1206.

Exception. Every bathroom and toilet room shall be provided with artificial light. The illumination shall have an average intensity of three footcandles (32.29 lux) measured at a level of 30 inches (762 mm) above the floor.

1205.2 Natural Light. The minimum net glazed area shall not be less than 8% of the floor area of the room served.

1205.2.1 Adjoining Spaces. For the purpose of natural lighting, any room is permitted to be considered as a portion of an adjoining room where ½ of the area of the common wall is open and unobstructed and provides an opening of not less than one-tenth of the floor area of the interior room or 25 square feet (2.32 m^2), whichever is greater.

1205.2.2 Exterior Openings. Exterior openings required by 780 CMR 1205.2 for natural light shall open directly onto a public way, yard or court, as set forth in 780 CMR 1206.0.

Exceptions:

1. Required exterior openings are permitted to open into a roofed porch where the porch:
   1.1. Abuts a public way, yard or court.
   1.2. Has a ceiling height of not less than 7 feet (2134 mm).
   1.3. Has a longer side at least 65% open and unobstructed.
2. Skylights are not required to open directly onto a public way, yard or court.

1205.3 Artificial Light. Artificial light shall be provided that is adequate to provide an average illumination of ten foot-candles (107 lux) over the area of the room at a height of 30 inches (762 mm) above the floor level.

1205.4 Stairway Illumination. Stairways within dwelling units and exterior stairways serving a dwelling unit shall have an illumination level on tread runs of not less than one foot-candle (11 lux). Stairs in other occupancies shall be governed by 780 CMR 10.00.

1205.4.1 Controls. The control for activation of the required stairway lighting shall be in accordance with 527 CMR 12.00: The Massachusetts Electrical Code).

1205.5 Emergency Egress Lighting. The means of egress shall be illuminated in accordance with 780 CMR 1006.1.

780 CMR 1206.0 YARDS OR COURTS

1206.1 General. 780 CMR 1206.0 shall apply to yards and courts adjacent to exterior openings that provide natural light or ventilation. Such yards and courts shall be on the same property as the building.

1206.2 Yards. Yards shall not be less than three feet (914 mm) in width for one- and two-story buildings. For buildings more than two stories in height, the minimum width of the yard shall be increased at the rate of one foot (305 mm) for each additional story. For buildings exceeding 14 stories in height, the required width of the yard shall be computed on the basis of 14 stories.

1206.3 Courts. Courts shall not be less than three feet (914 mm) in width. Courts having windows opening on opposite sides shall not be less than six feet (1829 mm) in width. Courts shall not be less than ten feet (3048 mm) in length unless bounded on one end by a public way or yard. For buildings more than two stories in height, the court shall be increased one foot (305 mm) in width and two feet (310 mm) in length for each additional story. For buildings exceeding 14 stories in height, the required dimensions shall be computed on the basis of 14 stories.

1206.3.1 Court Access. Access shall be provided to the bottom of courts for cleaning purposes.

1206.3.2 Air Intake. Courts more than two stories in height shall be provided with a horizontal air intake at the bottom not less than ten square feet (0.93 m^2) in area and leading to the exterior of the building unless abutting a yard or public way.

1206.3.3 Court Drainage. The bottom of every court shall be properly graded and drained to a public sewer or other approved disposal system complying with the *International Plumbing Code*.

780 CMR 1207.0 SOUND TRANSMISSION

1207.1 Scope. 780 CMR 1207.0 shall apply to common interior walls, partitions and floor/ceiling assemblies between adjacent dwelling units or between dwelling units and adjacent public areas such as halls, corridors, stairs or service areas.

1207.2 Air-borne Sound. Walls, partitions and floor/ceiling assemblies separating dwelling units from each other or from public or service areas shall have a sound transmission class (STC) of not less than 50 (45 if field tested) for air-borne noise when tested in accordance with ASTM E 90. Penetrations or openings in construction assemblies for piping; electrical devices; recessed cabinets; bathtubs; soffits; or heating, ventilating or exhaust ducts shall be sealed, lined, insulated or otherwise treated to maintain the required ratings. This requirement shall not apply to dwelling unit entrance doors; however, such doors shall be tight fitting to the frame and sill.

1207.3 Structure-borne Sound. Floor/ceiling assemblies between dwelling units or between a dwelling unit and a public or service area within the structure shall have an impact insulation class (IIC) rating of not less than 50 (45 if field tested) when tested in accordance with ASTM E 492.

780 CMR 1208.0 INTERIOR SPACE DIMENSIONS

1208.1 Minimum Room Widths. Habitable spaces, other than a kitchen, shall not be less than seven feet (2134 mm) in any plan dimension. Kitchens shall have a clear passageway of not less than three feet (914 mm) between counter fronts and appliances or counter fronts and walls.

1208.2 Minimum Ceiling Heights. Occupiable spaces, habitable spaces and corridors shall have a ceiling height of not less than seven feet six inches (2286 mm). Bathrooms, toilet rooms, kitchens, storage rooms and laundry rooms shall be permitted to have a ceiling height of not less than seven feet (2134 mm).

Exceptions:

1. In one- and two-family dwellings, see 780 CMR 5305.
2. If any room in a building has a sloped ceiling, the prescribed ceiling height for the room is required in one-half the area thereof. Any portion of the room measuring less than five feet (1524 mm) from the finished floor to the ceiling shall not be included in any computation of the minimum area thereof.
3. Mezzanines constructed in accordance with 780 CMR 505.1.

1208.2.1 Furred Ceiling. Any room with a furred ceiling shall be required to have the minimum ceiling height in ⅔ of the area thereof, but in no case shall the height of the furred ceiling be less than seven feet (2134 mm).

1208.3 Room Area. Every dwelling unit shall have at least one room that shall have not less than 120 square feet (13.9 m^2) of net floor area. Other habitable rooms shall have a net floor area of not less than 70 square feet (6.5 m^2).

Exception. Every kitchen in a one- and two-family dwelling shall have not less than 50 square feet (4.64 m^2) of gross floor area.

1208.4 Efficiency Dwelling Units. An efficiency living unit shall conform to the requirements of the code except as modified in 780 CMR 1208.4 items 1. through 4.:

1. The unit shall have a living room of not less than 220 square feet (20.4 m) of floor area. An additional 100 square feet (9.3 m) of floor area shall be provided for each occupant of such unit in excess of two.
2. The unit shall be provided with a separate closet.
3. The unit shall be provided with a kitchen sink, cooking appliance and refrigeration facilities, each having a clear working space of not less than 30 inches (762 mm) in front. Light and ventilation conforming to 780 CMR shall be provided.
4. The unit shall be provided with a separate bathroom containing a water closet, lavatory and bathtub or shower.

780 CMR 1209.0 ACCESS TO UNOCCUPIED SPACES

1209.1 Crawl Spaces. Crawl spaces shall be provided with a minimum of one access opening not less than 18 inches by 24 inches (457 mm by 610 mm).

1209.2 Attic Spaces. An opening not less than 20 inches by 30 inches (559 mm by 762 mm) shall be provided to any attic area having a clear height of over 30 inches (762 mm). A 30-inch (762 mm) minimum clear headroom in the attic space shall be provided at or above the access opening.

1209.3 Air Sealing Between Conditioned and Unconditioned Space. The doors, trap doors, scuttles, and/or openings so formed, separating conditioned from unconditioned space shall be fitted with gaskets, weather strips etc. and such openings shall close tight to minimize air transfer between conditioned and unconditioned space (also see 780 CMR 13.00).

1209.4 Mechanical Appliances. Access to mechanical appliances installed in under-floor areas, in attic spaces and on roofs or elevated structures shall be in accordance with the *International Mechanical Code*.

780 CMR 1210.0 SURROUNDING MATERIALS

1210.1 Floors. In other than dwelling units, toilet and bathing room floors shall have a smooth, hard, nonabsorbent surface that extends upward onto the walls at least six inches (152 mm).

1210.2 Walls. Walls within two feet (610 mm) of urinals and water closets shall have a smooth, hard, nonabsorbent surface, to a height of four feet (1219 mm) above the floor, and except for structural elements, the materials used in such walls shall be of a type that is not adversely affected by moisture.

Exceptions:

1. Dwelling units and sleeping units.
2. Toilet rooms that are not accessible to the public and which have not more than one water closet.

Accessories such as grab bars, towel bars, paper dispensers and soap dishes, provided on or within walls, shall be installed and sealed to protect structural elements from moisture.

1210.3 Showers. Shower compartments and walls above bathtubs with installed shower heads shall be finished with a smooth, nonabsorbent surface to a height not less than 70 inches (1778 mm) above the drain inlet.

1210.4 Waterproof Joints. Built-in tubs with showers shall have waterproof joints between the tub and adjacent wall.

1210.5 Toilet Rooms. Toilet rooms shall not open directly into a room used for the preparation of food for service to the public.

NON-TEXT PAGE

780 CMR 13.00

ENERGY CONSERVATION

780 CMR 13.00 is unique to Massachusetts

780 CMR 1301.0 ADMINISTRATION

1301.1 Scope. 780 CMR 13.00 sets forth requirements for the effective use of energy in structures other than *low rise residential buildings*, (low-rise residential structures shall be designed and constructed to comply with the requirements of 780 CMR 61.00 (refer to the 7th Edition *Massachusetts Building Code for One- and Two-Family Dwellings*).

> **Exception**. For the purposes of energy conservation, Use Group R-1 buildings are to be treated as *commercial buildings*.

1301.2 Compliance. Buildings shall be deemed to be in compliance with 780 CMR 13.00 when built to the provisions of 780 CMR 1301.0 and 1303.0, and either:

1. 780 CMR 1303.0 through 1308.0; or
2. 780 CMR 1309.0.

> **Exception**. As an alternative to the provisions of 780 CMR 1304.0, buildings with total floor area not greater than 10,000 square feet may be designed and constructed using the envelope requirements of 780 CMR 61.00 (refer to the 7th Edition *Massachusetts Building Code for One- and Two-Family Dwellings*).

1301.2.1 Heating, Pumping, Process Piping and Refrigeration Systems. Heating, pumping, process piping and refrigeration systems shall be installed by contractors and personnel appropriately licensed in the Commonwealth of Massachusetts (Installing Contractor). Engineered designs and specifications prepared by Registered Professional Engineers shall identify systems requiring compliance with appropriate sections of M.G.L. c. 146 and 528 CMR. Shop drawings and design layout prepared by licensed installing contractors shall note the name(s), license number(s) and license expiration date(s) of the contractor(s) installing the heating, pumping, process piping and refrigeration systems. (See Installing Contractor Definition 780 CMR 202.0).

1301.3 Other Regulations. 780 CMR 13.00 is not intended to abridge any safety or health provisions required under any other applicable codes or ordinances.

1301.4 Existing Buildings. Nothing in 780 CMR 13.00 shall require the removal, alteration, or abandonment, or prevent the continuance of the use and occupancy of, a lawfully existing building, unless provided otherwise specifically by 780 CMR 13.00.

1301.5 Additions to Existing Buildings. Additions to existing buildings or structures shall be made without making the entire building or structure comply. The new construction shall conform to the provisions of 780 CMR 13.00 as they relate to the addition only.

1301.6 Alterations to Existing Buildings. See 780 CMR 3407.0.

1301.7 Exempt Buildings. The following buildings are exempt from the further provisions of 780 CMR 13, with the exception of 780 CMR 1308.0 dealing with lighting requirements:

1. Buildings and structures or portions thereof whose peak design rate of energy usage is less than one watt per square foot or three and four tenths (3.4) Btu/h per square foot of floor area for all purposes;
2. Buildings and structures or portions thereof which are neither heated nor cooled;
3. *Greenhouses* that are free-standing, or attached to a building and separated by a wall having the same thermal value as an exterior wall, and provided with a separate temperature control system;
4. Buildings with less than 100 square feet of gross floor area.
5. Portions of aircraft hangars where aircraft are housed or stored and/or aircraft servicing, repairs or alterations may occur. Such hangars are also exempt from the lighting requirements of 780 CMR 1308.0.

1301.8 Plans and Specifications.

1301.8.1 General. Plans, specifications and necessary computations shall be submitted to indicate conformance with 780 CMR 1301.8 and other applicable sections of 780 CMR. Submittals shall include Mandatory Checklist approved by the Board of Building Regulations and Standards.

1301.8.2 Construction Details. Compliance documents shall show all pertinent data and features of the *building*, *equipment*, and *systems* in sufficient detail to permit a determination of the compliance by the *building* official and to indicate compliance with the requirements of this standard. Supplemental information necessary to verify compliance with this standard, such as calculations, worksheets, compliance forms, vendor literature, or other data, shall be made available when required by the *building official*.

1301.8.3 Calculation Procedures. Calculation procedures shall be in accordance with the

ASHRAE Handbook, 2005 Fundamentals Volume or as otherwise specified in 780 CMR 13.00.

1301.8.4 Approval and Acceptance of Heating, Ventilating, and Air Conditioning (HVAC); Lighting; and Electric Distribution Systems.

1301.8.4.1 Construction Documents. The construction documents shall contain sufficient information to completely describe the heating, ventilation, and air conditioning (HVAC); lighting; and electric power distribution systems, including operational features and controls. The information required for each system shall include a summary of:

1. A description of the design intent providing a detailed explanation of the ideas, concepts and criteria that are defined by the owner to be important.
2. A description of the basis of design of the systems including all information necessary to prepare a design to accomplish the design intent.
3. A description of the sequence of operation of the systems and their interaction with other systems, including fire prevention and fire protection systems.
4. A description of the systems including the capacities of the equipment or systems.
5. A description of the testing requirements and the criteria for passing to be used for final systems acceptance.
6. A requirement for submittal of operation manuals and maintenance manuals as a condition of final acceptance, and a description of their format and content. The operation manual shall provide all relevant information needed for day-to-day operation and management of each system. The maintenance manual shall describe equipment inventory and support the maintenance program.
7. A requirement for submittal of record drawings and control documents as a condition of final acceptance, per 780 CMR 116.0.

1301.8.4.2 Approval. Approval by the building official of the design concepts, testing procedures, and acceptance criteria of 780 CMR 1301.8.4.1, 1. through 7., is not required, but the building official shall reject the construction documents if these sections are incomplete, or if they specify any design elements that violate other requirements of 780 CMR.

1301.8.4.3 Design. All HVAC, lighting, and electric power distribution systems including sequence of operation, controls and supporting documentation shall be designed and specified by a qualified Registered Professional Engineer except as provided in M.G.L. c. 143, § 54A and any profession or trade as provided in M.G.L. c. 112, § 60L and M.G.L. c. 112, § 81R. The Registered Professional Engineer(s) or other legally recognized professional (M.G.L. c. 112, § 81R) shall be responsible for the review and certification that all submittals and shop drawings conform to the approved HVAC, lighting, and electric power distribution construction documents as submitted for the building permit and approved by the building official, per 780 CMR 116.0.

1301.8.4.4 Acceptance. In accordance with the provisions of 780 CMR 120.0, a certificate of occupancy shall not be issued until the building official or his designees have witnessed a satisfactory test of all HVAC, lighting control, and electric power distribution systems installed in accordance with the construction documents. All systems shall be tested in accordance with the applicable standards of 780 CMR and documents. In addition, the following documents shall be simultaneously submitted to the building official prior to the issuance of a permanent certificate of occupancy.

1. Certification from the Registered Professional, as allowed in 780 CMR 116.2, stating that the HVAC, lighting, and electric power distribution systems have been installed in substantial accord with the approved construction documents.
2. Confirmation by the building owner/ developer or authorized representative that they have received all HVAC, lighting, and electric power distribution system record drawings from the installing contractors and that the Registered Professional Engineer or other legally recognized professional (M.G.L. c. 112, § 81R) has reviewed their reasonable accuracy.
3. Confirmation by the building owner/ developer or authorized representative that they have received all construction documents required in 780 CMR 1301.8.4.1 including reports, controls documentation, operation manual(s) and maintenance manual(s).

Exception. In lieu of witnessing a satisfactory functional test, the building official or their designees may accept a final performance acceptance test report from a Registered Professional Engineer or other legally recognized professional (M.G.L. c. 112, § 81R). Said report shall certify that the systems have been tested and satisfactorily meet their performance requirements.

1301.8.4.5 Unsafe Lighting and Ventilation. The *building official* may require or accept the documentation required in 780 CMR

1301.8.4.4 in enforcing the provisions of 780 CMR 3400.6.

1301.8.4.6 Conditional Acceptance. The requirements of 780 CMR 1301.8.4.4 shall not preclude the issuance of a temporary certificate of occupancy by the Building Official in accordance with 780 CMR 120.3 as long as it can be demonstrated that compliance can be accomplished with the building occupied.

1301.9 Materials and Equipment.

1301.9.1 Identification. Where practicable, all materials and equipment referenced in 780 CMR 1301.8 shall be marked in order to show compliance with 780 CMR 13.00.

1301.9.2 Maintenance Information. Service systems which require preventive maintenance to maintain efficient operation shall be furnished with complete necessary maintenance information. Required routine maintenance actions, as specified by the manufacturer, shall be stated clearly and incorporated on a readily accessible label on the equipment. Such label may be limited to identifying, by title or publication number, the operation and maintenance manual for that particular model and type of product.

1301.9.3 Fenestration and Doors. Product samples used for determining *fenestration* performance shall be production line units or representative of units as purchased by the consumer or contractor.

1301.9.3.1 U-Factor. *U-factors* shall be determined in accordance with AAMA 1503 or NFRC 100. *U-factors* for *skylights* shall be determined in accordance with NFRC 100. *U-factor* shall be determined by an independent laboratory accredited by a nationally recognized accreditation organization and shall be certified by the manufacturer.

Exceptions:

1. If a manufacturer of windows, window systems, skylights, glazed or unglazed door has not determined product U-value in accordance with 780 CMR 1301.9.3.1, compliance with the requirements of 780 CMR 13.00 shall be determined only by assigning such products a default U-value in accordance with Table 1301.9.3.1a or 1301.9.3.1b. Product features must be verifiable for the product to qualify for the default value associated with those features. Where existence of a particular feature cannot be determined with reasonable certainty, the product shall not receive credit for that feature. Where a composite of materials from two different product types is used, the product shall be assigned the higher U-value.
2. For garage doors, ANSI/DASMA 105 shall be an acceptable alternate for determining U Factor.

TABLE 1301.9.3.1a U-VALUE DEFAULT TABLE FOR WINDOWS, CURTAIN WALLS, AND SKYLIGHTS[a]

Frame Material and Product Type[b]	Single Glazed	Double Glazed	Double Glazed Low-e[c]	Triple Glazed	Triple Glazed Low-e[c]
Metal without Thermal Break					
Windows	1.27	0.87	0.79	0.72	0.69
Curtain Walls	1.22	0.79	0.70	0.63	0.59
Skylight	1.98	1.31	1.20	1.12	1.08
Site-assembled sloped/overhead glazing	1.36	0.82	0.71	0.64	0.60
Metal with Thermal Break					
Windows	1.07	0.63	0.54	0.48	0.44
Curtain Walls	1.61	0.68	0.59	0.52	0.48
Skylight	1.89	1.61	1.00	0.89	0.85
Site-assembled sloped/overhead glazing	1.25	0.70	0.60	0.53	0.49
Wood/Vinyl/Fiberglass					
Windows	0.98	0.56	0.48	0.41	0.37
Skylight	1.75	0.84	0.74	0.64	0.59

a. Certain values in this table do not meet the limits of **780 CMR 1304.2, Prescriptive Building Envelope Criteria**, or **780 CMR 1305, Building Envelope Trade-Off Option**, and may be used only when demonstrating compliance using **780 CMR 1309, Building Design by Systems Analysis.**

b. Glass block assemblies with mortar but without reinforcing or framing shall have a default value of 0.60.

c. Presence of low-e coating must be certified in writing by the manufacturer.

TABLE 1301.9.3.1b U-VALUE DEFAULT TABLE FOR DOORS

Door Type	
Opaque	0.70
Glass	0.92
Air Lock Entry	0.50
Revolving	0.50
Overhead	1.45

1301.9.3.2 Solar Heat Gain Coefficient. *Solar heat gain coefficient (SHGC)* for the overall *fenestration area* shall be determined in accordance with NFRC 200. *Solar heat gain coefficient* shall be determined by an independent laboratory accredited by a nationally recognized accreditation organization and shall be certified by the manufacturer.

> **Exception.** If a manufacturer of windows, window systems, skylights, glazed or unglazed door has not determined product Solar Heat Gain Coefficient in accordance with 780 CMR 1301.9.3.2, compliance with the requirements of 780 CMR 13.00 shall be determined only by assigning such products a default SHGC in accordance with Table 1301.9.3.2. Credit for low-e coating may be taken only if presence of such coating is certified in writing by the manufacturer.

1301.9.3.3 Visible Light Transmittance. When 780 CMR 1304.5 is used with daylighting credit, visible light transmittance shall be determined in accordance with NFRC 200. Visible light transmittance shall be determined by an independent laboratory accredited by a nationally recognized accreditation organization and shall be certified by the manufacturer.

> **Exception.** If a manufacturer of windows, window systems, skylights, glazed or unglazed door has not determined product Visible Light Transmittance in accordance with 780 CMR 1301.9.3.3, compliance with the requirements of 780 CMR 13.00 shall be determined only by assigning such products a default VLT in accordance with Table 1301.9.3.2. Credit for low-e coating may be taken only if presence of such coating is certified in writing by the manufacturer.

TABLE 1301.9.3.2 SHGC AND VLT DEFAULT TABLE FOR FENESTRATION[a]

Glass Type	Metal Frame		Non-Metal Frame	
	SHGC	VLT	SHGC	VLT
Single Glazed				
Clear	0.78	0.80	0.76	0.78
Tinted	0.67	0.61	0.65	0.59
Reflective	0.53	0.37	0.52	0.36
Double Glazed				
Clear	0.68	0.72	0.66	0.70
Tinted	0.57	0.55	0.56	0.54
Reflective	0.46	0.32	0.45	0.31
Double Glazed Low-e				
Clear	0.64	0.68	0.63	0.66
Tinted	0.59	0.50	0.58	0.49
Reflective	0.46	0.32	0.45	0.31
Triple Glazed				
Clear	0.61	0.66	0.60	0.64
Tinted	0.42	0.22	0.41	0.22
Reflective	0.36	0.25	0.35	0.25
Triple Glazed Low-e				
Clear	0.57	0.61	0.56	0.59
Tinted	0.42	0.33	0.41	0.32
Reflective	0.36	0.25	0.35	0.25

a Presence of low-e coating must be certified in writing by the manufacturer.

780 CMR 1302.0 DEFINITIONS

1302.1 Meaning. Unless otherwise expressly stated, the following terms shall, for the purpose of 780 CMR 13.00, have the meaning indicated in 780CMR 1302.0.

1302.2 Tense, Gender and Number. Words used in the present tense include the future; words used in the masculine gender include the feminine and neuter; the singular number includes the plural and the plural the singular.

1302.3 Terms Not Defined. Where terms are not defined, they shall have their ordinarily accepted meanings or such as the context may imply. Any terms relating to plumbing and electrical wiring shall have their terms as defined by the Regulations of the Commonwealth of Massachusetts pertaining to plumbing and electrical wiring.

Accessible (As Applied to Equipment). Admitting close approach because not guarded by locked doors, elevation or other effective means (see "Readily accessible").

Air Conditioning, Comfort. The process of treating air so as to control simultaneously its temperature, humidity, cleanliness, and distribution to meet requirements of the conditioned space.

Air Transport Factor. The ratio of the rate of useful sensible heat removal from the conditioned space to the energy input to the supply and return fan motor(s), expressed in consistent units and under the designated operating conditions.

Automatic. Self-acting, operating by its own mechanism when actuated by some impersonal influence, as, for example, a change in current strength, pressure, temperature or mechanical configuration (see "Manual").

Ballast. A device used in conjunction with an electric-discharge lamp to cause the lamp to start and operate under the proper circuit conditions of voltage, current, wave form, electrode heat, etc.

Electronic Ballast. A ballast constructed using electronic circuitry.

Hybrid Ballast. A ballast constructed using a combination of magnetic core and insulated wire winding and electronic circuitry.

Magnetic Ballast. A ballast constructed with magnetic core and a winding of insulated wire.

Below-grade Wall. The opaque portion of a wall which encloses one side of a basement and is partially or totally below grade.

Boiler. An appliance designed to heat water or generate steam (see "Packaged boiler".)

Building Area. The greatest horizontal area of a building above grade within the outside surface of exterior walls or within the outside surface of exterior wall and the center line of fire walls.

Building Envelope. The elements of a building which enclose conditioned spaces through which thermal energy may be transferred to or from the exterior or to or from unconditioned spaces or other spaces exempted by the provisions of 780 CMR 1301.7.

Building Entrance. Any doorway, set of doors, turnstiles, or other form of portal that is ordinarily used to gain access to the building by its users and occupants.

Building Grounds Lighting. Lighting provided through a building's electrical service for parking lot, site, roadway, pedestrian pathway, loading dock, and security applications.

Building Project. A building or group of buildings, including on-site energy conversion or electric-generating facilities, which utilize a single submittal for a construction permit or are within the boundary of a contiguous area under one ownership.

Coefficient of Performance (COP) - Heat Pump - Heating. The ratio of the rate of heat delivered to the rate of energy input, in consistent units, for a complete heat pump system under designated operating conditions.

Comfort. The physical conditions represented in the area on a psychometric chart enclosing all those conditions described in Figure 1 in ASHRAE 55, as listed in 780 CMR 35.00, as being comfortable.

Commercial Building. For purposes of energy conservation, a commercial building is any building other than a low-rise residential building, as defined in 780 CMR J2.0.

Conditioned Floor Area. The horizontal projection of that portion of interior space which is contained within exterior walls and which is conditioned directly or indirectly by an energy-using system.

Conditioned Space. Space within a building which is provided with positive heat supply (see definition), or which has heated and/or cooled air or surfaces, or where required, with humidification or dehumidification means so as to be capable of maintaining a space condition falling within the comfort zone set forth in ASHRAE 55, as listed in 780 CMR 35.00.

Continuous Air Barrier. the combination of interconnected materials and assemblies, joined and sealed together with flexible joints that provide the air-tightness of the building envelope above and below grade that separate conditioned from unconditioned space, or from space with conditions that differ by more than 50% .

Continuous Insulation (ci). Insulation that is continuous across all structural members without any thermal bridges, excluding fasteners and service openings. It is installed on the interior, exterior, or integral to any opaque surface of the building envelope.

Control Device. A specialized device used to regulate the operation of equipment.

Dead band. The temperature range in which no heating or cooling is used.

Degree Day, Cooling (CDD). A unit, based upon temperature difference and time, used in estimating cooling energy consumption. For any one day, when the mean temperature is more than 65°F., there are as many degree days as degrees Fahrenheit temperature difference between the mean temperature for the day and 65°F. Annual Cooling Degree Days (CDD) are the sum of the degree days over a calendar year.

Degree Day, Heating (HDD). A unit, based upon temperature difference and time, used in estimating fuel consumption and specifying nominal heating load of a building in winter. For any one day, when the mean temperature is less than 50°F., there exists as many degree days as there are Fahrenheit degrees difference in temperature between the mean temperature for the day and 50°F. Annual Heating Degree Days (HDD) are the sum of the degree days over a calendar year.

Design Conditions. Specified environmental conditions, such as temperature and light intensity, required to be produced and maintained by a system and under which the system must operate.

Direct Digital Control (DDC). A type of control where controlled and monitored analog or binary data (e.g., temperature, contact closures) are converted to digital format for manipulation and calculations by a digital computer or microprocessor, then converted back to analog or binary form to control physical devices.

Distribution System. Conveying means, such as ducts, pipes, and wires, to bring substances or energy from a source to the point of use. The distribution system includes such auxiliary equipment as fans, pumps, and transformers.

Door. All operable opening areas (which are not fenestration) in the building envelope, including swinging and roll-up doors, fire doors, and access hatches. Doors that are more than one-half glass are considered fenestration. (See Fenestration.) For the purposes of determining building envelope requirements, the classifications are defined as follows:

> **Non-swinging**. Roll-up, sliding, and all other doors that are not swinging doors.
>
> **Swinging.** All operable opaque panels with hinges on one side and opaque revolving doors.

Door Aea. Total area of the door measured using the rough opening and including the door slab and the frame. (See "Fenestration area.")

Economizer, air. A duct and damper arrangement and automatic control system that together allows a cooling system to supply outside air to reduce or eliminate the need for mechanical cooling during mild or cold weather.

Economizer, water. A system by which the supply air of a cooling system is cooled indirectly with water that is itself cooled by heat or mass transfer to the environment without the use of mechanical cooling.

Efficiency. Performance at specified rating conditions.

Efficiency, HVAC System. The ratio of useful energy output (at the point of use) to the energy input in consistent units for a designated time period, expressed in percent.

Emergency Power System. A system that operates in the event of primary system failure or provides power to essential loads during power supply outages.

Enclosed Space. A volume substantially surrounded by solid surfaces such as walls, floors, roofs, and openable devices such as doors and operable windows.

Enclosure. The case or housing of an apparatus, or the fence or walls surrounding an installation, to prevent personnel from accidentally contacting energized parts or protect equipment from physical damage.

Energy. The capacity for doing work taking a number of forms which may be transformed from one into another, such as thermal (heat), mechanical (work), electrical and chemical in customary units, measured in kilowatt-hours (kWh) or British thermal units (Btu) (J) (see "New Energy").

New Energy. Energy, other than recovered energy, utilized for the purpose of heating or cooling (see "Energy").

Energy Efficiency Ratio (EER). The ratio of net equipment cooling capacity in Btu/h to total rate of electric input in watts (W) under designated operating conditions. If the output capacity in Btu/h is converted to watts (to create consistent units) the result is equal to the cooling COP (EER 3.41 = COP). See also Coefficient of Performance.

Energy, Recovered. (See "Recovered energy.")

Exfiltration. The uncontrolled outward air leakage through cracks and interstices in any building element and around windows and doors of a building caused by the pressure effects of wind and/or the effect of differences in the indoor and outdoor air density.

Existing Buildings. For purposes of energy conservation, and existing building which has been legally occupied and/or used for a period of at least five years. (Also see 780 CMR 2.00 and 780 CMR 3400.3.1.)

Exterior Lighting Power Allowance. (See "Lighting power allowance.")

Façade Area, Vertical. Area of the façade, including non-horizontal roof area, overhangs, and cornices, measured in elevation in a vertical plane parallel to the plane of the face of the building.

F-factor. The perimeter heat loss factor for slab-on-grade floors, expressed in Btu/h*ft*°F.

Fan System Energy Demand (Or Fan System Power). The sum of the nominal power demand (nameplate horsepower) of motors of all fans that are required to operate at design conditions to supply air from the heating or cooling source to the conditioned space(s) and return it to the source or exhaust it to the outdoors.

Fenestration. All areas (including the frames) in the building envelope that let in light, including windows, plastic panels, clerestories, skylights, glass doors that are more than one-half glass, and glass block walls. (See Building envelope and Door.)

Skylight. A fenestration surface having a slope of less than 60° from the horizontal plane. Other fenestration, even if mounted on the roof of a building, is considered vertical fenestration.

Vertical fenestration. All fenestration other than skylights.

Fenestration Area. Total area of the fenestration measured using the rough opening and including the glazing, sash, and frame. For doors where the glazed vision area is less than 50% of the door area, the fenestration area is the glazed vision area. For all other doors, the fenestration area is the door area. (See "Door area.")

Fenestration, Vertical. (See "Fenestration" and "Skylight.")

Fixture. The component of a luminaire that houses the lamp or lamps, positions the lamp, shields it from view, and distributes the light. The fixture also provides for connection to the power supply, which may require the use of a ballast.

Floor. That lower portion of the building envelope, including opaque area and fenestration, that has conditioned or semiheated space above and is horizontal or tilted at an angle of less than 60 degrees from horizontal but excluding slab-on-grade floors. For the purposes of determining building envelope requirements, the classifications are defined as follows:

Mass Floor. A floor with a heat capacity that exceeds:

1. 7 Btu/ft2*°F or
2. 5 Btu/ft2*°F provided that the floor has a material unit weight not greater than 120 lb/ft^3.

Steel Joist Floor. A floor that:

1. is not a mass floor and
2. which has steel joist members supported by structural members.

Wood Framed and Other Floors. All other floor types, including wood joist floors.

(See "Building envelope", "Fenestration", "Opaque area", and "Slab-on-grade floor.")

Floor Area, Gross. The sum of the floor areas of the spaces within the building including basements, mezzanine and intermediate-floored tiers, and penthouses with headroom height of 7.5 ft (2.3 m) or greater. It is measured from the exterior faces of exterior walls or from the centerline of walls separating buildings, but excluding covered walkways, open roofed-over areas, porches and similar spaces, pipe trenches, exterior terraces or steps, chimneys, roof overhangs, and similar features.

Gross Building Envelope Floor Area. The gross floor area of the building envelope, but excluding slab-on-grade floors.

Gross Conditioned Floor Area. The gross floor area of conditioned spaces.

Gross Lighted Floor Area. The gross floor area of lighted spaces.

Gross Semiheated Floor Area. The gross floor area of semiheated spaces.

(See "Building envelope", "Floor", "Slab-on-grade floor," and "Space.")

Flue Damper. A device in the flue outlet or in the inlet of or upstream of the draft control device of an individual, automatically operated, fossil fuel-fired appliance that is designed to automatically open the flue outlet during appliance operation and to automatically close the flue outlet when the appliance is in a standby condition.

Footcandle (fc). The illuminance on a surface one ft^2 in area on which there is a uniformly distributed flux of one lumen, or the illuminance produced on a surface all points of which are at a distance of one foot from a directionally uniform point source of one candle. (For SI users, one footcandle equals 10.76 lux.)

Fossil Fuel. An organic material, other than wood, used as a fuel.

Furnace, Duct. A furnace normally installed in distribution ducts of air conditioning systems to supply warm air for heating and which depends on a blower not furnished as part of the duct furnace for air circulation.

Furnace, Warm Air. A self-contained, indirect-fired or electrically heated furnace that supplies heated air through ducts to spaces that require it.

Glazed Wall System. A category of site assembled fenestration products used in the NFRC 100 and NFRC 200 rating procedures which includes, but is not limited to, curtain walls and solariums.

Grade. The finished ground level adjoining a building at all exterior walls.

Glazing Area. Interior surface area of all glazed surfaces (such as windows, sliding glass doors, skylights, etc.), sash, curbing, jambs, or other framing elements that enclose conditioned spaces.

Gross Area of Exterior Walls. The normal projection of the building envelope wall area bounding interior space which is conditioned by an energy-using system including opaque wall, window and door area.

The gross area of exterior walls consists of all opaque wall areas, including between floor spandrels, peripheral edges of floors, roof and basement knee walls, walls enclosing a mansard roof, window areas including sash, and door areas when such surfaces are exposed to outdoor air, unconditioned spaces, or mechanically cooled space, including interstitial areas between two such spaces. For each basement wall that encloses heated space, if the average below-grade area is less than 50% of the total area for that wall, including openings, the entire wall, including the below-grade portion is included as part of the gross area of exterior walls. Non-opaque areas (windows, doors, etc.) of all basement walls are included in the gross area of exterior walls. (Note. if the basement is not heated space, and if the basement ceiling is insulated, then the basement walls are not included in the gross area of exterior walls.

Gross Floor Area. The sum of the areas of the several floors of the building, including basements, cellars, mezzanine and intermediate floored tiers and penthouses of headroom height, measured from the exterior faces of exterior walls or from the center line of walls separating buildings, but excluding:

1. covered walkways, open roofed-over areas, porches and similar spaces.
2. pipe trenches, exterior terraces or steps, chimneys, roof overhangs and similar features.

Heat. The form of energy that is transferred by virtue of a temperature difference or a change in state of a material.

Heated Space. Space within a building which is provided with a positive heat supply. Space within a basement with registers or heating devices designed to supply heat to a basement space shall automatically define that space as heated space.

Humidistat. An automatic control device used to maintain humidity at a fixed or adjustable set point.

HVAC. Heating, ventilating, and air conditioning.

HVAC System. The equipment, distribution network, and terminals that provide either collectively or individually the processes of heating, ventilating, or air conditioning to a building.

HVAC System Components. HVAC system components provide, in one or more factory-assembled packages, means for chilling and/or heating water with controlled temperature for delivery to terminal units serving the conditioned spaces of the building. Types of HVAC system components include, but are not limited to, water chiller packages, reciprocating condensing units and water source (hydronic) heat pumps (See "HVAC system equipment").

HVAC System Efficiency. (See "Efficiency, HVAC system.")

HVAC System Equipment. HVAC system equipment provides, in one (single package) or more (split system) factory-assembled packages, means for air circulation, air cleaning, air cooling with controlled temperature and dehumidification, and, optionally, either alone or in combination with a heating plant, the functions of heating and humidifying. The cooling function may be either electrically or heat operated and the refrigerant condenser may be air, water or evaporatively cooled. Where the equipment is provided in more than one package, the separate packages shall by designed by the manufacturer to be used together. The equipment may provide the heating function as a heat pump or by the use of electric or fossil-fuel-fired elements. (The word "equipment" used without modifying adjective may, in accordance with common industry usage, apply either to HVAC system equipment or HVAC system components.)

Indirectly Conditioned Space. (See "Space.")

Infiltration. The uncontrolled inward air leakage through cracks and interstices in any building element and around windows and doors of a building caused by the pressure effects of wind and/or the effect of differences in the indoor and outdoor air density.

Installed Interior Lighting Power. The power in watts of all permanently-installed general, task, and furniture lighting systems and luminaires as indicated on plans and specifications.

Integrated Part-load Value (IPLV). A single number figure of merit based on part-load EER or COP expressing part-load efficiency for air-conditioning and heat pump equipment on the basis of weighted operation at various load capacities for the equipment.

Interior Lighting Power Allowance. (See "Lighting power allowance.")

Isolation Devices. Devices that isolate HVAC zones so that they can be operated independently of one another. Isolation devices include, but are not limited to, separate systems, isolation dampers, and controls providing shutoff at terminal boxes.

Lighting Power Allowance.

Interior Lighting Power Allowance. The maximum lighting power in watts allowed for the interior of a building.

Exterior Lighting Power Allowance. The maximum lighting power in watts allowed for the exterior of a building.

Lighting Power Density (LPD). The maximum lighting power per unit area of a building classification of space function.

Low-rise Residential Buildings. Residential occupancy buildings (R-2, R-3, R-4, or R-5) three stories or less in height. (Exception. For purposes of energy conservation, R-1 use group buildings shall be treated as commercial buildings as defined in 780 CMR J2.0.)

Lumen (lm). The luminous flux emitted within a unit solid angle (one steradian) by a point source having a uniform luminous intensity of 1 cd.

Luminaire. A complete lighting unit consisting of a lamp or lamps together with the housing designed to distribute the light, position and protect the lamps, and connect the lamps to the power supply.

Manufacturer. The company engaged in the original production and assembly of products or equipment or a company that purchases such products and equipment manufactured in accordance with company specifications.

Manual. Capable of being operated by personal intervention (See "Automatic.")

Multi-family Dwelling. A building containing three or more dwelling units.

Net Area of Exterior Walls. The gross area of exterior walls, minus the total rough opening area of all windows and doors set in the exterior walls.

Nondepletable Energy Sources. Sources of energy (excluding minerals and solid fuels) derived from incoming solar radiation, including natural daylighting and photosynthetic processes; from phenomena resulting there from, including wind, waves and tides, lake or pond thermal differences; and from the internal heat of the earth, including nocturnal thermal exchanges.

Nonrecirculating System. A domestic or service hot water distribution system that is not a recirculating system.

Occupant Sensor. A device that detects the presence or absence of people within an area and causes lighting, equipment, or appliances to be regulated accordingly.

Opaque Areas. All exposed areas of a building envelope which enclose conditioned space, except openings for windows, skylights, doors and building service systems.

Outdoor Air. Air taken from the outdoors and therefore not previously circulated through the system.)

Packaged Boiler. A boiler that is shipped complete with heating equipment, mechanical draft equipment, and automatic controls; usually shipped in one or more sections.

Plenum. An enclosure that is part of the air distribution system and is distinguished by having almost uniform air pressure. A plenum often is formed in part or in total by portions of the building.

Pool. A body of non-potable water contained in a human-made structure intended and large enough for substantial immersion of one or more people. The term includes but is not limited to swimming pool, whirlpool, spa, and hot tub.

Positive Heat Supply. Heat deliberately supplied to a space by design, such as a supply register, radiator or heating element. Also, heat indirectly supplied to a space through uninsulated surfaces of service water heaters and space heating components, such as furnaces, boilers and heating and cooling distribution systems which continually maintain air temperature within the space of 50°F. or higher during normal operation.

Projection Factor (PF). The ratio of the horizontal depth of the external shading projection divided by the sum of the height of the fenestration and the distance from the top of the fenestration to the bottom of the farthest point of the external shading projection, in consistent units.

Proposed Design. A description of the proposed building design used to estimate annual energy costs for determining compliance based on 780 CMR 1309.0.

Rated R-value of Insulation. The thermal resistance of the insulation alone as specified by the manufacturer according to recognized trade and engineering standards in units of h*ft2*°F/Btu at a mean temperature of 75°F. Rated R-value refers to the thermal resistance of the added insulation in framing cavities or insulated sheathing only and does not include the thermal resistance of other building materials or air films. (See "Thermal resistance.")

Readily Accessible. Capable of being reached quickly for operation, renewal or inspections, without requiring those to whom ready access is requisite to climb over or remove obstacles or to resort to portable ladders or access equipment (see "Accessible.")

Recooling. The removal of heat by sensible cooling of the supply air (directly or indirectly) that has been previously heated above the temperature to which the air is to be supplied to the conditioned space for proper control of the temperature of that space.

Record Drawings. Drawings that record the conditions of the project as constructed. These include any refinements of the construction or bid documents.

Recovered Energy. Energy utilized which would otherwise be wasted (i.e., not contribute to a desired end use) from an energy utilization system.

Reheat. The application of sensible heat to supply air that has been previously cooled below the temperature of the conditioned space by either mechanical refrigeration or the introduction of outdoor air to provide cooling.

Reset. Adjustment of the set point of a control instrument to a higher or lower value automatically or manually to conserve energy.

Roof Assembly. A roof assembly shall be considered as all components of the roof/ceiling envelope through which heat flows, thus creating a building transmission heat loss or gain, where such assembly is exposed to outdoor air and encloses a heated or mechanically cooled space.

The gross area of a roof assembly consists of the total interior surface of such assembly, including skylights exposed to the heated or mechanically cooled space.

Sequence. A consecutive series of operations.

Service Systems. All energy-using systems in a building that are operated to provide services for the occupants or processes housed therein, including HVAC, service water heating, illumination, transportation, cooking or food preparation, laundering and similar functions.

Service Water Heating. Supply of hot water for purposes other than space heating.

Setback. Reduction of heating (by reducing the set point) or cooling (by increasing the setpoint) during hours when a building is unoccupied or during periods when lesser demand is acceptable.

Slab-on-grade. A floor slab for which the top edge of the perimeter is above the finished grade or 12 inches or less below the finished grade.

Solar Energy Source. Source of natural daylighting and of thermal, chemical or electrical energy derived directly from conversion of incident solar radiation.

Solar Heat Gain Coefficient (SHGC). The ratio of the solar heat gain entering the space through the fenestration area to the incident solar radiation. Solar heat gain includes directly transmitted solar heat and absorbed solar radiation, which is then reradiated, conducted, or convected into the space. (See fenestration area.)

Standard Design. A version of the proposed design that meets the minimum requirements of 780 CMR 1300 and is used to determine the annual energy usage for determining compliance based on 780 CMR 1309.0.

System. A combination of central or terminal equipment or components and/or controls, accessories, interconnecting means, and terminal devices by which energy is transformed so as to perform a specific function, such as HVAC, service water heating or illumination.

Thermal Conductance (C). Time rate of heat flow through a body (frequently per unit area) from one of its bounding surfaces to the other for a unit temperature difference between the two surfaces, under steady conditions (Btu/h*ft*2*°F.).

Thermal Resistance (R). The reciprocal of thermal conductance (h*ft*2*°F/Btu).

Thermal Resistance, Overall (Ro). The reciprocal of overall thermal conductance (h*ft*2*°F /Btu) [(m2.k)/W]. The overall thermal resistance of the gross area or individual component of the exterior building envelope (roof/ceiling, exterior wall, floor, crawl space wall, foundation, window, skylight, door, or opaque wall, etc.) which includes the weighted R-values of the component assemblies (such as air-film, insulation, drywall, framing, glazing, etc.).

Thermal Transmittance (U). The coefficient of heat transmission (air to air). It is the time rate of heat flow per unit area and unit temperature difference between the warm side and cold side air films (Btu/ h*ft*2*°F.) The U-value applies to combinations of different materials used in series along the heat flow path, single materials that comprise a building section, cavity air spaces and surface air films on both sides of a building element. The term F-value applies to U properties for concrete slabs.

Thermal Transmittance, Overall (Uo). The overall (average) heat transmission of a gross area of the exterior building envelope (Btu/ h*ft*2*°F.) The Uo value applies to the combined effect of the time rate of heat flow through the various parallel paths, such as windows, doors and opaque construction areas, comprising the gross area of one or more exterior building components, such as walls, floors or roof/ceilings.

Thermostat. An automatic control device actuated by temperature and designed to be responsive to temperature.

Thermostatic Control. An automatic control device or system used to maintain temperature at a fixed or adjustable set point.

Transformer. A piece of electrical equipment used to convert electric power from one voltage to another voltage.

Dry-type Transformer. A transformer in which the core and coils are in a gaseous or dry compound.

Liquid-immersed Transformer. A transformer in which the core and coils are immersed in an insulating liquid.

Unitary Cooling and Heating Equipment. One or more factory-made assemblies which include an evaporator or cooling coil, a compressor and condenser combination, and may include a heating function as well. When heating and cooling equipment is provided in more than one assembly, the separate assemblies shall be designed to be used together.

Unitary Heat Pump. One or more factory-made assemblies which include an indoor conditioning coil, compressor(s) and outdoor coil or refrigerant-to-water heat exchanger, including means to provide both heating and cooling functions. When heat pump equipment is provided in more than one assembly, the separate assemblies shall be designed to be used together.

Variable Air Volume (VAV) System. HVAC system that controls the dry-bulb temperature within a space by varying the volumetric flow of heated or cooled supply air to the space.

Vent Damper. A device intended for installation in the venting system of an individual, automatically-operated, fossil fuel fired appliance in the outlet or downstream of the appliance draft control device which is designed to automatically open the venting system when the appliance is in operation and to automatically close off the venting system when the appliance is in a standby or shutdown condition.

Ventilation. The process of supplying or removing air by natural or mechanical means to or from any space. Such air may or may not have been conditioned.

Ventilation Air. That portion of supply air which comes from outside (outdoors) plus any recirculated air that has been treated to maintain the desired quality of air within a designated space. (See BOCA Mechanical Code, as listed in 780 CMR 35.00, 78 CMR J3, and definition of "Outdoor air.")

Voltage Drop. A decrease in voltage caused by losses in the lines connecting the power source to the load.

Wall. That portion of the building envelope, including opaque area and fenestration, that is vertical or tilted at an angle of 60° from horizontal or greater. This includes above- and below-grade walls, between floor spandrels, peripheral edges of floors, and foundation walls. For the purposes of determining building envelope requirements, the classifications are defined as follows:

Above-grade Wall. A wall that is not a below-grade wall.

Below-grade Wall. That portion of a wall in the building envelope that is entirely below the finish grade and in contact with the ground.

Metal Building Wall. a wall whose structure consists of metal spanning members supported by steel structural members (i.e., does not include spandrel glass or metal panels in curtain wall systems).

Steel Framed Wall. A wall with a cavity (insulated or otherwise) whose exterior surfaces are separated by steel framing members (i.e., typical steel stud walls and curtain wall systems).

Wood Framed and Other Walls. All other wall types, including wood stud walls.

Wall Area, Gross. The area of the wall measured on the exterior face from the top of the floor to the bottom of the roof.

Water Heater. Closed vessel in which water is heated by the combustion of fuels, electricity, or any other source and is withdrawn for use external to the system at pressures not exceeding 160 psig, including the apparatus by which heat is generated and all controls and devices necessary to prevent water temperatures from exceeding 210°F.

Zone. A space or group of spaces within a building with heating and/or cooling requirements sufficiently similar so that comfort conditions can be maintained throughout by a single controlling device.

780 CMR 1303.0 DESIGN CONDITIONS

1303.1 Scope. 780 CMR 1303.0 applies to all buildings.

1303.2 General. The criteria of 780 CMR 1303.0 establish the minimum requirements for the thermal design of the exterior envelope of buildings and for HVAC systems and equipment.

1303.3 Design Parameters. The design parameters listed in Tables 1303.1 and 1303.2 shall be used for calculations required under 780 CMR 13.00.

1303.3.1 Interior Design Conditions. Indoor design temperature and relative humidity shall be determined in accordance with ASHRAE Standard 55-92 listed in 780 CMR 35.00, and shall be selected for minimum total HVAC system energy use in accordance with accepted practice.

Exception. Buildings or portions of buildings which require different temperatures and humidity, such as, but not limited to, hospitals, laboratories, museums, art galleries, supermarkets, thermally sensitive equipment rooms, archival storage facilities, and facilities for the elderly, may require the use of alternative indoor design conditions. Any such use of alternative indoor design conditions shall be documented by a licensed professional.

1303.4 Ventilation. Ventilation air shall conform to the requirements specified in 780 CMR 2801.0.

TABLE 1303.1 CLIMATE ZONE BY COUNTY

County	Climate Zone #
Barnstable	12a
Berkshire	14a
Bristol	12a
Dukes	12a
Essex	13a
Franklin	14a
Hampden	14a
Hampshire	14a
Middlesex	13a
Nantucket	12a
Norfolk	13a
Plymouth	12a
Suffolk	13a
Worcester	14a

TABLE 1303.2 CLIMATE ZONE THERMAL DESIGN CRITERIA

Climate Zone #	12a	13a	14a
Heating Degrees (°F) Winter	9	7	-1
Cooling Degrees (°F) Dry Bulb Summer	86	87	86
Cooling Degrees (°F) Wet Bulb Summer	74	74	73
Heating Degree Days Base 65	5884	5641	6894
Heating Degree Days Base 50	2553	2399	3448
Cooling Degree Days Base 65	606	678	507
Cooling Degree Days Base 50	2743	2897	2525
Cooling Degree Hours Base 80	939	1299	409

780 CMR 1304.0 BUILDING ENVELOPE REQUIREMENTS

1304.1 General. Walls, roof assemblies, floors, glazing, and floor slabs which are part of the *building envelope* shall meet the requirements of 780 CMR 1304.1, 1304.3, 1304.4 and either:

1. 780 CMR 1304.2, Prescriptive Building Envelope Criteria, provided that:
   a the building is less than 4 stories in height above grade;
   b. the *vertical fenestration area* does not exceed 50% of the *gross wall area* for each *space conditioning category*; and,
   c. the *skylight fenestration area* does not exceed 3% of the *gross roof area* for each *space-conditioning category*; or,
2. 780 CMR 1304.5, Building Envelope Trade-off Option.

1304.1.1 Classification of Walls. Walls associated with the *building envelope* shall be classified in accordance with 780 CMR 1304.1.1.1, 1304.1.1.2 or 1304.1.1.3.

1304.1.1.1 Above-grade Walls. Above-grade walls are those walls covered by 780 CMR 1304.2.1 on the exterior of the building and completely above grade or the above-grade portion of a basement or first-story wall that is more than 15% above grade.

1304.1.1.2 Below-grade Walls. Below-grade walls covered by 780 CMR 1304.2.9 are basement or first-story walls associated with the exterior of the building that are at least 85% below grade.

1304.1.1.3 Interior Walls. Interior walls covered by 780 CMR 1304.2.10 are those walls not on the exterior of the building and that separate conditioned and unconditioned space.

1304.1.2 Moisture Control. The design of buildings for energy conservation shall not create conditions of accelerated deterioration from moisture condensation.

A vapor retarder shall be installed on the winter warm side of walls, ceilings and floors enclosing a conditioned space. Batt/blanket insulation with a vapor retarder attached shall be attached to the winter warm sides or faces of wall studs, sole plates, top plates, lintels and headers at intervals of eight inches on center to prevent convection loops through the insulation. Where batt/blanket insulation is of a "friction fit" design and a sheet vapor retarder is employed, the vapor retarder shall be affixed to the interior face of the wall studs, sole plates, top plates, lintels and headers winter warm side in accordance with the vapor retarder manufacturer's recommendations.

All other envelope building materials and finishes installed towards the cooler, exterior side of the wall shall have water vapor permeance at least ten times greater than the interior vapor retarder material.

Exceptions:

1. Materials to the exterior of a ventilated rainscreen cavity may have any permability.
2. Envelope systems that maintain the temperature of potential condensing surfaces (typically the interface of exterior sheathing with cavity insulation) above the dewpoint temperature of the interior air.

3. Envelope systems that maintain the moisture content of all building materials that comprise the assembly to the interior of the water-resistive barrier below the equilibrium moisture content the materials would achieve when exposed to relative humidity of 80%.
4. Buildings with unusual interior design conditions (such as continually refrigerated buildings, ice rinks, cold storage) shall demonstrate compliance by the method in 780 CMR 1304.1.2, Exception 3.

1304.2 Prescriptive Building Envelope Criteria. The building envelope components shall meet each of the applicable requirements in Tables 1304.2.1-12, based on the climate zone and the percentage of wall that is glazed. The climate zone shall be determined based on the county in accordance with 780 CMR 1302, Tables 1302.1 and 1302.2. The percentage of wall that is glazed shall be determined by dividing the aggregate area of rough openings or unit dimensions for *fenestration* (windows and glazed doors) in all the above grade walls associated with the building envelope by the total gross area of all above grade exterior walls that are part of the building envelope. In buildings with multiple types of building envelope construction, each building envelope construction type shall be evaluated separately.

1304.2.1 Above Grade Walls. The minimum thermal resistance (R-value) of the insulating material installed in the wall cavity between the framing members and continuously on the walls shall be as specified in Tables 1304.2.1-12 based on framing type and construction materials used in the wall assembly. Where both cavity and continuous insulation values are provided in Tables 1304.2.1-12, both requirements shall be met. Masonry walls shall be considered "framed walls" when weighing less than 35 psf of wall area.

1304.2.2 Non-glazed Doors. When the total area of non-glazed doors is greater than 5% of the total opaque wall area, the area of non-glazed doors above 5% shall be insulated as an opaque wall or an adjustment shall be made in the thermal resistance of the wall to address any thermal deficiency created by the doors.

1304.2.3 Windows and Glass Doors. The maximum solar heat gain coefficient (SHGC) and thermal transmittance (U-value) of window assemblies and glass doors located in the building envelope shall be as specified in Tables 1304.2.1-12 based on the window projection factor.

The window projection factor shall be determined in accordance with Equation 1304.2.3.

Equation 1304.2.3

$$PF = A/B$$

Where:
PF = Projection factor (decimal).
A = Distance measured horizontally from the extremity of any overhang, eave, or permanently attached shading device to the vertical surface of the glazing.
B = Distance measured vertically from the bottom of the glazing to the underside of the overhang, eave, or permanently attached shading device.

Where different windows or glass doors have different *PF* values they shall each be evaluated separately or an area weighted *PF* value shall be calculated and used for all windows and glass doors.

1304.2.4 Roof Assembly. The minimum thermal resistance (R-value) of the insulating material installed either between the roof framing or continuously on the roof assembly shall be as specified in Tables 1304.2.1-12 based on construction materials used in the roof assembly.

1304.2.5 Skylights. Skylights located in the building envelope shall be limited to 3% of the gross roof assembly area and shall have a maximum thermal transmittance (U-value) of the skylight assembly as specified in Tables 1304.2.1-12.

1304.2.6 Floors over Outdoor Air or Unconditioned Space. The minimum thermal resistance (R-value) of the insulating material installed either between the floor framing or continuously on the floor assembly shall be as specified in Tables 1304.2.1-12 based on construction materials used in the floor assembly.

1304.2.7 Slabs on Grade. The minimum thermal resistance (R-value) of the insulation around the perimeter of the slab floor on grade shall be R-5. The insulation shall be placed on the outside of the foundation or on the inside of a foundation wall. Insulation on the outside of the foundation wall shall extend downward from the top of the slab for a minimum of 48 in. Insulation on the inside of the foundation wall shall extend downward to at least the bottom of the slab and then horizontally for a minimum total distance of 48 in. In addition, the entire area of the slab on grade shall be insulated with a minimum of R-5 rigid insulation in the following buildings. buildings of use group E, including daycare; buildings of use groups R-1, R-2, I-1 and I-2, and; college and university buildings of B and A use groups.

Exception. For a monolithic slab on grade floor, the insulation shall extend from the top of the slab on grade to the bottom of the footing. Continuous under-slab insulation shall be provided per 780 CMR 1304.2.8.

1304.2.8 Slabs below Grade. The entire area of a floor slab which is below grade and is in contact with the ground shall be insulated with a minimum of R-5 rigid insulation in the following buildings. buildings of use group E, including daycare; buildings of use groups R-1, R-2, I-1 and I-2, and; college and university buildings of B and A use groups.

1304.2.9 Below Grade Walls. The minimum thermal resistance of the insulating material installed in, or continuously on, below grade walls of conditioned spaces shall be R-5, and shall extend from the top of the wall to the depth of the bottom of the floor slab.

1304.2.10 Interior Walls. The minimum thermal resistance (R-value) of the insulating material installed in the wall cavity or continuously on the interior walls separating *conditioned space* from *unconditioned space* shall be as specified in Tables 1304.2.1, 1304.2.5, and 1304.2.9 for above grade walls, regardless of glazing area, based on framing type and construction materials used in the wall assembly.

TABLE 1304.2.1 BUILDING ENVELOPE REQUIREMENTS
Climate Zone 12a
Glazing Area 10% or less of Above Grade Wall Area

Above-Grade Walls:	**Continuous Insulation (or average insulation value)***	**Metal Framing (c.i. = continuous insulation)**	**Wood Framing**
Framed or Masonry < 35 psf.	R-7	R-11 + R-3 c.i.	R-11
Masonry >= 35 psf.	R-5	R-11 + R-3 c.i.	R-11

Window Assemblies:	**SHGC (maximum)**	**U-Value (maximum)**	
PF < 0.25	Any	Any	
0.25 <= PF < 0.50	Any	Any	
PF >= 0.50	Any	Any	
Skylights - U-Value (maximum)	NA	0.8	

Roof Assemblies. (either/or)	**Insulation Between Framing**	**Continuous Insulation**	
All-Wood Joist/Truss	R-19	R-16	
Non-wood Joist/Truss	R-25	R-17	
Concrete Slab or Deck	NA	R-16	
Metal Purlin with Thermal Break	R-25	R-17	
Metal Purlin w/o Thermal Break	NA	R-17	

Floor Assemblies. (either/or)	**Insulation Between Framing**	**Continuous Insulation**	
All-Wood Joist/Truss	R-19	R-16	
Non-wood Joist/Truss	R-19	R-16	
Concrete Slab or Deck	NA	R-16	
Slab, Perimeter, and Below-Grade Wall	R-5		

* For masonry walls, average R-value shall be calculated based on the assumption of isothermal planes, using methodology in 2005 ASHRAE Fundamentals Handbook, Chapter 25.

TABLE 1304.2.2 BUILDING ENVELOPE REQUIREMENTS
Climate Zone 12a
Glazing Area Over 10% but not greater than 25% of Above Grade Wall Area

Above-Grade Walls:	**Continuous Insulation (or average insulation value)***	**Metal Framing (c.i. = continuous insulation)**	**Wood Framing**
Framed or Masonry < 35 psf	R-7	R-11 + R-3 c.i.	R-11
Masonry >= 35 psf.	R-5	R-11 + R-3 c.i.	R-11

Window Assemblies:	**SHGC (maximum)**	**U-Value (maximum)**	
PF < 0.25	0.6	0.6	
0.25 <= PF < 0.50	0.7	0.6	
PF >= 0.50	Any	0.6	
Skylights - U-Value (maximum)	NA	0.8	

Roof Assemblies. (either/or)	**Insulation Between Framing**	**Continuous Insulation**	
All-Wood Joist/Truss	R-25	R-19	
Non-wood Joist/Truss	R-25	R-20	
Concrete Slab or Deck	NA	R-19	
Metal Purlin with Thermal Break	R-30	R-20	
Metal Purlin w/o Thermal Break	NA	R-20	

Floor Assemblies. (either/or)	**Insulation Between Framing**	**Continuous Insulation**	
All-Wood Joist/Truss	R-19	R-16	
Non-wood Joist/Truss	R-19	R-16	
Concrete Slab or Deck	NA	R-16	
Slab, Perimeter, and Below-Grade Wall	R-5		

TABLE 1304.2.3 BUILDING ENVELOPE REQUIREMENTS
Climate Zone 12a
Glazing Area Over 25% but not greater than 40% of Above Grade Wall Area

Above-Grade Walls:	**Continuous Insulation (or average insulation value)***	**Metal Framing (c.i. = continuous insulation)**	**Wood Framing**
Framed or Masonry < 35 psf.	R-7	R-11 + R-3 c.i.	R-11
Masonry >= 35 psf.	R-5	R-11 + R-3 c.i.	R-11

Window Assemblies:	**SHGC (maximum)**	**U-Value (maximum)**	
PF < 0.25	0.5	0.5	
0.25 <= PF < 0.50	0.6	0.5	
PF >= 0.50	0.7	0.5	
Skylights - U-Value (maximum)	NA	0.8	

Roof Assemblies. (either/or)	**Insulation Between Framing**	**Continuous Insulation**	
All-Wood Joist/Truss	R-30	R-23	
Non-wood Joist/Truss	R-30	R-24	
Concrete Slab or Deck	NA	R-23	
Metal Purlin with Thermal Break	NA	R-24	
Metal Purlin w/o Thermal Break	NA	R-24	

Floor Assemblies. (either/or)	**Insulation Between Framing**	**Continuous Insulation**	
All-Wood Joist/Truss	R-19	R-16	
Non-wood Joist/Truss	R-19	R-16	
Concrete Slab or Deck	NA	R-16	
Slab, Perimeter, and Below-Grade Wall	R-5		

* For masonry walls, average R-value shall be calculated based on the assumption of isothermal planes, using methodology in 2005 ASHRAE Fundamentals Handbook, Chapter 25.

TABLE 1304.2.4 BUILDING ENVELOPE REQUIREMENTS
Climate Zone 12a
Glazing Area Over 40% but not greater than 50% of Above Grade Wall Area

Above-Grade Walls:	**Continuous Insulation (or average insulation value)***	**Metal Framing (c.i. = continuous insulation)**	**Wood Framing**
Framed or Masonry < 35 psf.	R-7	R-13 + R-3 c.i.	R-11
Masonry >= 35 psf.	R-5	R-11 + R-3 c.i.	R-11

Window Assemblies:	**SHGC (maximum)**	**U-Value (maximum)**	
PF < 0.25	0.4	0.4	
0.25 <= PF < 0.50	0.5	0.4	
PF >= 0.50	0.7	0.4	
Skylights - U-Value (maximum)	NA	0.8	

Roof Assemblies. (either/or)	**Insulation Between Framing**	**Continuous Insulation**	
All-Wood Joist/Truss	R-30	R-23	
Non-wood Joist/Truss	R-30	R-24	
Concrete Slab or Deck	NA	R-23	
Metal Purlin with Thermal Break	R-30	R-24	
Metal Purlin w/o Thermal Break	R-38	R-24	

Floor Assemblies. (either/or)	**Insulation Between Framing**	**Continuous Insulation**	
All-Wood Joist/Truss	R-19	R-16	
Non-wood Joist/Truss	R-19	R-16	
Concrete Slab or Deck	NA	R-16	
Slab, Perimeter, and Below-Grade Wall	R-5		

TABLE 1304.2.5 BUILDING ENVELOPE REQUIREMENTS
Climate Zone 13a
Glazing Area 10% or less of Above Grade Wall Area

Above-Grade Walls:	**Continuous Insulation (or average insulation value)***	**Metal Framing (c.i. = continuous insulation)**	**Wood Framing**
Framed or Masonry < 35 psf.	R-7	R-13 + R-3 c.i.	R-11
Masonry >= 35 psf.	R-5	R-11 + R-3 c.i.	R-11

Window Assemblies:	**SHGC (maximum)**	**U-Value (maximum)**	
PF < 0.25	Any	0.7	
0.25 <= PF < 0.50	Any	0.7	
PF >= 0.50	Any	0.7	
Skylights - U-Value (maximum)	NA	0.8	

Roof Assemblies. (either/or)	**Insulation Between Framing**	**Continuous Insulation**	
All-Wood Joist/Truss	R-19	R-14	
Non-wood Joist/Truss	R-19	R-15	
Concrete Slab or Deck	NA	R-14	
Metal Purlin with Thermal Break	R-25	R-15	
Metal Purlin w/o Thermal Break	NA	R-15	

Floor Assemblies. (either/or)	**Insulation Between Framing**	**Continuous Insulation**	
All-Wood Joist/Truss	R-19	R-16	
Non-wood Joist/Truss	R-25	R-17	
Concrete Slab or Deck	NA	R-17	
Slab, Perimeter, and Below-Grade Wall	R-5		

* For masonry walls, average R-value shall be calculated based on the assumption of isothermal planes, using methodology in 2005 ASHRAE Fundamentals Handbook, Chapter 25.

TABLE 1304.2.6 BUILDING ENVELOPE REQUIREMENTS
Climate Zone 13a
Glazing Area Over 10% but not greater than 25% of Above Grade Wall Area

Above-Grade Walls:	**Continuous Insulation (or average insulation value)***	**Metal Framing (c.i. = continuous insulation)**	**Wood Framing**
Framed or Masonry < 35 psf.	R-7	R-13 + R-3 c.i.	R-11
Masonry >= 35 psf.	R-5	R-11 + R-3 c.i.	R-11

Window Assemblies:	**SHGC (maximum)**	**U-Value (maximum)**	
PF < 0.25	0.6	0.6	
0.25 <= PF < 0.50	0.7	0.6	
PF >= 0.50	Any	0.6	
Skylights - U-Value (maximum)	NA	0.8	

Roof Assemblies. (either/or)	**Insulation Between Framing**	**Continuous Insulation**	
All-Wood Joist/Truss	R-25	R-19	
Non-wood Joist/Truss	R-25	R-20	
Concrete Slab or Deck	NA	R-19	
Metal Purlin with Thermal Break	R-30	R-20	
Metal Purlin w/o Thermal Break	NA	R-20	

Floor Assemblies. (either/or)	**Insulation Between Framing**	**Continuous Insulation**	
All-Wood Joist/Truss	R-19	R-16	
Non-wood Joist/Truss	R-25	R-17	
Concrete Slab or Deck	NA	R-17	
Slab, Perimeter, and Below-Grade Wall	R-5		

TABLE 1304.2.7 BUILDING ENVELOPE REQUIREMENTS
Climate Zone 13a
Glazing Area Over 25% but not greater than 40% of Above Grade Wall Area

Above-Grade Walls:	**Continuous Insulation (or average insulation value)***	**Metal Framing (c.i. = continuous insulation)**	**Wood Framing**
Framed or Masonry < 35 psf.	R-7	R-13 + R-3 c.i.	R-11
Masonry >= 35 psf.	R-5	R-11 + R-3 c.i.	R-11

Window Assemblies:	**SHGC (maximum)**	**U-Value (maximum)**	
PF < 0.25	0.5	0.5	
0.25 <= PF < 0.50	0.6	0.5	
PF >= 0.50	0.7	0.5	
Skylights - U-Value (maximum)	NA	0.8	

Roof Assemblies. (either/or)	**Insulation Between Framing**	**Continuous Insulation**	
All-Wood Joist/Truss	R-30	R-23	
Non-wood Joist/Truss	R-30	R-24	
Concrete Slab or Deck	NA	R-23	
Metal Purlin with Thermal Break	NA	R-24	
Metal Purlin w/o Thermal Break	NA	R-24	

Floor Assemblies. (either/or)	**Insulation Between Framing**	**Continuous Insulation**	
All-Wood Joist/Truss	R-19	R-16	
Non-wood Joist/Truss	R-25	R-17	
Concrete Slab or Deck	NA	R-17	
Slab, Perimeter, and Below-Grade Wall	R-5		

* For masonry walls, average R-value shall be calculated based on the assumption of isothermal planes, using methodology in 2005 ASHRAE Fundamentals Handbook, Chapter 25.

TABLE 1304.2.8 BUILDING ENVELOPE REQUIREMENTS
Climate Zone 13a
Glazing Area Over 40% but not greater than 50% of Above Grade Wall Area

Above-Grade Walls:	**Continuous Insulation (or average insulation value)***	**Metal Framing (c.i. = continuous insulation)**	**Wood Framing**
Framed or Masonry < 35 psf.	R-7	R-13 + R-3 c.i.	R-11
Masonry >= 35 psf.	R-5	R-11 + R-3 c.i.	R-11

Window Assemblies:	**SHGC (maximum)**	**U-Value (maximum)**	
PF < 0.25	0.4	0 4	
0.25 <= PF < 0.50	0.5	0.4	
PF >= 0.50	0.7	0.4	
Skylights - U-Value (maximum)	NA	0.8	

Roof Assemblies. (either/or)	**Insulation Between Framing**	**Continuous Insulation**	
All-Wood Joist/Truss	R-30	R-23	
Non-wood Joist/Truss	R-30	R-24	
Concrete Slab or Deck	NA	R-23	
Metal Purlin with Thermal Break	R-30	R-24	
Metal Purlin w/o Thermal Break	R-38	R-24	

Floor Assemblies. (either/or)	**Insulation Between Framing**	**Continuous Insulation**	
All-Wood Joist/Truss	R-19	R-16	
Non-wood Joist/Truss	R-25	R-17	
Concrete Slab or Deck	NA	R-17	
Slab, Perimeter, and Below-Grade Wall	R-5		

TABLE 1304.2.9 BUILDING ENVELOPE REQUIREMENTS
Climate Zone 14a
Glazing Area 10% or less of Above Grade Wall Area

Above-Grade Walls:	**Continuous Insulation (or average insulation value)***	**Metal Framing (c.i. = continuous insulation)**	**Wood Framing**
Framed or Masonry < 35 psf.	R-7	R-11 + R-3 c.i.	R-11
Masonry >= 35 psf.	R-5	R-11 + R-3 c.i.	R-11

Window Assemblies:	**SHGC (maximum)**	**U-Value (maximum)**	
PF < 0.25	Any	0.7	
0.25 <= PF < 0.50	Any	0.7	
PF >= 0.50	Any	0.7	
Skylights - U-Value (maximum)	NA	0.8	

Roof Assemblies. (either/or)	**Insulation Between Framing**	**Continuous Insulation**	
All-Wood Joist/Truss	R-19	R-17	
Non-wood Joist/Truss	R-25	R-18	
Concrete Slab or Deck	NA	R-17	
Metal Purlin with Thermal Break	R-30	R-18	
Metal Purlin w/o Thermal Break	NA	R-18	

Floor Assemblies. (either/or)	**Insulation Between Framing**	**Continuous Insulation**	
All-Wood Joist/Truss	R-25	R-18	
Non-wood Joist/Truss	R-25	R-19	
Concrete Slab or Deck	NA	R-19	
Slab, Perimeter, and Below-Grade Wall	R-5		

* For masonry walls, average R-value shall be calculated based on the assumption of isothermal planes, using methodology in 2005 ASHRAE Fundamentals Handbook, Chapter 25.

TABLE 1304.2.10 BUILDING ENVELOPE REQUIREMENTS
Climate Zone 14a
Glazing Area Over 10% but not greater than 25% of Above Grade Wall Area

Above-Grade Walls:	**Continuous Insulation (or average insulation value)***	**Metal Framing (c.i. = continuous insulation)**	**Wood Framing**
Framed or Masonry < 35 psf.	R-7	R-13 + R-3 c.i.	R-11
Masonry >= 35 psf.	R-5	R-11 + R-3 c.i.	R-11

Window Assemblies:	**SHGC (maximum)**	**U-Value (maximum)**	
PF < 0.25	0.5	0.6	
0.25 <= PF < 0.50	0.6	0.6	
PF >= 0.50	0.7	0.6	
Skylights - U-Value (maximum)	NA	0.8	

Roof Assemblies. (either/or)	**Insulation Between Framing**	**Continuous Insulation**	
All-Wood Joist/Truss	R-25	R-19	
Non-wood Joist/Truss	R-25	R-20	
Concrete Slab or Deck	NA	R-19	
Metal Purlin with Thermal Break	R-30	R-20	
Metal Purlin w/o Thermal Break	NA	R-20	

Floor Assemblies. (either/or)	**Insulation Between Framing**	**Continuous Insulation**	
All-Wood Joist/Truss	R-25	R-18	
Non-wood Joist/Truss	R-25	R-19	
Concrete Slab or Deck	NA	R-19	
Slab, Perimeter, and Below-Grade Wall	R-5		

TABLE 1304.2.11 BUILDING ENVELOPE REQUIREMENTS
Climate Zone 14a
Glazing Area Over 25% but not greater than 40% of Above Grade Wall Area

Above-Grade Walls:	**Continuous Insulation (or average insulation value)***	**Metal Framing (c.i. = continuous insulation)**	**Wood Framing**
Framed or Masonry < 35 psf.	R-7	R-13 + R-3 c.i.	R-11
Masonry >= 35 psf.	R-5	R-11 + R-3 c.i.	R-11

Window Assemblies:	**SHGC (maximum)**	**U-Value (maximum)**	
PF < 0.25	0.4	0.5	
0.25 <= PF < 0.50	0.5	0.5	
PF >= 0.50	0.6	0.5	
Skylights - U-Value (maximum)	NA	0.8	

Roof Assemblies. (either/or)	**Insulation Between Framing**	**Continuous Insulation**	
All-Wood Joist/Truss	R-30	R-23	
Non-wood Joist/Truss	R-30	R-24	
Concrete Slab or Deck	NA	R-23	
Metal Purlin with Thermal Break	NA	R-24	
Metal Purlin w/o Thermal Break	NA	R-24	

Floor Assemblies. (either/or)	**Insulation Between Framing**	**Continuous Insulation**	
All-Wood Joist/Truss	R-25	R-18	
Non-wood Joist/Truss	R-25	R-19	
Concrete Slab or Deck	NA	R-19	
Slab, Perimeter, and Below-Grade Wall	R-5		

* For masonry walls, average R-value shall be calculated based on the assumption of isothermal planes, using methodology in 2005 ASHRAE Fundamentals Handbook, Chapter 25.

TABLE 1304.2.12 BUILDING ENVELOPE REQUIREMENTS
Climate Zone 14a
Glazing Area Over 40% but not greater than 50% of Above Grade Wall Area

Above-Grade Walls:	**Continuous Insulation (or average insulation value)***	**Metal Framing (c.i. = continuous insulation)**	**Wood Framing**
Framed or Masonry < 35 psf.	R-7	R-13 + R-3 c.i.	R-11
Masonry >= 35 psf.	R-5	R-11 + R-3 c.i.	R-11

Window Assemblies:	**SHGC (maximum)**	**U-Value (maximum)**	
PF < 0.25	0.4	0.4	
0.25 <= PF < 0.50	0.5	0.4	
PF >= 0.50	0.6	0.4	
Skylights - U-Value (maximum)	NA	0.8	

Roof Assemblies. (either/or)	**Insulation Between Framing**	**Continuous Insulation**	
All-Wood Joist/Truss	R-30	R-23	
Non-wood Joist/Truss	R-30	R-24	
Concrete Slab or Deck	NA	R-23	
Metal Purlin with Thermal Break	R-38	R-24	
Metal Purlin w/o Thermal Break	R-38	R-24	

Floor Assemblies. (either/or)	**Insulation Between Framing**	**Continuous Insulation**	
All-Wood Joist/Truss	R-25	R-18	
Non-wood Joist/Truss	R-25	R-19	
Concrete Slab or Deck	NA	R-19	
Slab, Perimeter, and Below-Grade Wall	R-5		

* For masonry walls, average R-value shall be calculated based on the assumption of isothermal planes, using methodology in 2005 ASHRAE Fundamentals Handbook, Chapter 25.

1304.3 Air Leakage.

1304.3.1 Air Barriers. The building envelope shall be designed and constructed with a *continuous air barrier* to control air leakage into, or out of the conditioned space. An air barrier shall also be provided for interior partitions between conditioned space and space designed to maintain temperature or humidity levels which differ from those in the conditioned space by more than 50% of the difference between the conditioned space and design ambient conditions. The *continuous air barrier* shall have the following characteristics:

1. Materials used in the *continuous air barrier* shall have an air permeance not to exceed 0.004 cfm/ft^2 under a pressure differential of 0.3 in. water. (1.57 psf.) (equal to 0.02L/s.m^2 @ 75 Pa.) when tested in accordance with ASTM E 2178. Air barrier materials shall be taped or sealed in accordance with the manufacturer's instructions.
2. It shall be capable of withstanding positive and negative combined design wind, fan and stack pressures on the envelope without damage or displacement, and shall transfer the load to the structure. It shall not displace adjacent materials under full load.
3. Air barrier materials shall be maintainable, or, if inaccessible, shall meet durability requirements for the service life of the envelope assembly.
4. The air barrier material of an envelope assembly shall be joined and sealed in a flexible manner to the air barrier material of adjacent assemblies, allowing for the relative movement of assemblies due to thermal and moisture variations and creep. Connection shall be made between:
    a. Foundation and walls.
    b. Walls and windows or doors.
    c. Different wall systems.
    d. Wall and roof.
    e. Wall and roof over unconditioned space.
    f. Walls, floor and roof across construction, control and expansion joints.
    g. Walls, floors and roof to utility, pipe and duct penetrations.

1304.3.2 Air Barrier Penetrations. All penetrations of the air barrier and paths of air infiltration/exfiltration shall be sealed.

1304.3.3 Fenestration and Doors. Air leakage for *fenestration* and *doors* shall be determined in accordance with NFRC 400 or ASTM E 283 @ 1.57 psf (75 Pa.) Air leakage shall be determined by an independent laboratory accredited by a nationally recognized accreditation organization and shall be certified by the manufacturer. Air leakage shall not exceed 1.0 cfm/ft^2 for glazed swinging entrance doors and for revolving doors, and 0.4 cfm/ft^2 for all other products under a pressure differential of 0.3 inches of water (1.57 psf.)

Exceptions:

1. Field fabricated *fenestration* and *doors* that are weather-stripped.
2. For garage *doors*, air leakage determined by test at standard test conditions in accordance with ANSI/DASMA 105 shall be an acceptable alternate for compliance with air leakage requirements.

1304.3.4 Shaft, Chute, Access Opening, Stairwell and Elevator Lobby Doors. Doors and access openings leading to shafts, chutes, stairwells, and elevator lobbies shall either meet the requirements of 780 CMR 1304.3.3 or shall be equipped with weatherseals.

Exception. Weatherseals on elevator lobby doors are not required when a smoke control system is installed in accordance with 780 CMR 921.7.

1304.3.5 Loading Dock Weatherseals. Cargo *doors* and loading dock *doors* shall be equipped with weatherseals to restrict *infiltration* when vehicles are parked in the doorway.

1304.3.6 Vestibules. A *door* that separates *conditioned space* from the exterior shall be protected with an enclosed vestibule, with all *doors* opening into and out of the vestibule equipped with self-closing devices. Vestibules shall be designed so that in passing through the vestibule it is not necessary for the interior and exterior *doors* to open at the same time. Interior and exterior *doors* shall have a minimum distance between them of not less than seven feet (2.1 m) when in the closed position.

Exceptions:

1. *doors* not intended to be used as a *building entrance door*, such as doors for mechanical or electrical equipment rooms;
2. *doors* opening directly from a *dwelling unit*;
3. *doors* that open directly from a space less than 3000 ft^2 (200 m^2) in area
4. revolving *doors* or *doors* adjacent to revolving *doors*;
5. *doors* used primarily to facilitate vehicular movement or material handling and adjacent personnel *doors*.

1304.3.7 Air-tight Dampers. Air-tight operable dampers shall be installed where the air barrier is penetrated by:

1. fixed open louvers such as in elevator shafts and machine rooms;
2. mechanical system components which allow infiltration or exfiltration of air when the systems are inactive, such as atrium smoke exhaust systems and make-up air louvers;
3. outside air intakes, exhaust outlets, relief outlets, stair shaft, elevator shaft smoke relief openings, and other similar elements.

Such dampers shall have a leakage no greater than 3cfm/ft² at 1.0 in w.g. when tested in accordance with AMCA Standard 500. They shall be set in the closed position, and shall automatically open upon.

1. the activation of any fire alarm initiating device of the building's fire alarm system;
2. the interruption of power to the damper.

1304.3.8 Recessed Lighting Fixtures. When installed in the building envelope, recessed lighting fixtures shall meet one of the following requirements:

1. Type IC rated, manufactured with no penetrations between the inside of the recessed fixture and ceiling cavity and sealed or gasketed to prevent air leakage into the unconditioned space.
2. Type IC rated, in accordance with ASTM E 283 no more than 2.0 cfm air movement from the conditioned space to the ceiling cavity. The lighting fixture shall be tested at 75 Pa or 1.57 lbs./ft.^{2} pressure difference and shall be labeled.

1304.3.9 Envelope Gaps and Cavities. All gaps and cavities between rough framing and door and window heads, jambs, and sills shall be filled with insulation and the window and door frames sealed to air barrier or adjacent assemblies.

1304.4 Insulation General. Where insulation is required in 780 CMR 1304.2 or 1304.5, it shall also comply with 780 CMR 1304.4.1 through 1304.4.5.

1304.4.1 Insulation Installation. Insulation materials shall be installed in accordance with manufacturer's recommendations as to achieve and maintain *rated R-value of insulation*.

Where continuous wall insulation is required in 780 CMR 1304.2 or 1304.5 in multi-story buildings, the insulation must be continuous across floor structures.

Open-blown or poured loose-fill insulation shall not be used in *attic roof* spaces with eave vents when the slope of the ceiling is more than three in twelve unless special provisions are made to prevent settling and maintain an air space for ventilation above the insulation. Baffling of the vent openings shall be provided to deflect the incoming air above the surface of the insulation.

1304.4.2 Substantial Contact. Insulation shall be installed in a permanent manner in *substantial contact* with adjacent surfaces in a manner which will prevent convection of air around the insulation. Flexible batt insulation installed in floor cavities shall be supported in a permanent manner by supports no greater than 24 in. on center.

Batt insulation with integral vapor barrier shall be attached to the winter warm sides or faces of wall studs, sole plates, top plates, lintels and headers at intervals of eight inches on center. Where batt/blanket insulation is of a "friction fit" design and a poly vapor barrier is employed, the vapor barrier shall be affixed to the interior face of the wall studs, sole plates, top plates, lintels and headers (winter warm side) in accordance with the insulation manufacturer's recommendations.

1304.4.3 Recessed Equipment. Lighting fixtures; heating, ventilating, and air-conditioning equipment, including wall heaters, ducts, and plenums; and other equipment shall not be recessed in such a manner to affect the insulation thickness unless:

1. the total combined area affected (including necessary clearances) is less than one% of the opaque area of the assembly, or
2. the entire *roof*, *wall*, or *floor* is covered with insulation to the full depth required or
3. the effects of reduced insulation are included in calculations using an area weighted average method and compressed insulation values from the ASHRAE 1997 Handbook of Fundamentals. In all cases, air leakage through the recessed equipment to the *conditioned space* shall be prevented.

1304.4.4 Location of Roof Insulation. The *roof* shall be insulated in a location other than directly on a suspended ceiling with removable ceiling panels.

1304.4.5 Insulation Protection. Exterior insulation shall be covered with a protective material to prevent damage from sunlight, moisture, landscaping operations, equipment maintenance, and wind. In *attics* and mechanical rooms, a way to access equipment that prevents damaging or compressing the insulation shall be provided. Foundation vents shall not interfere with the insulation.

Insulation materials in ground contact shall have water absorption no greater than 0.3% when tested in accordance with ASTM C272.

Exception. Insulation materials that have a water drainage system included.

1304.5 Building Envelope Trade-off Option. The *building envelope* complies with the standard if the proposed building satisfies the provisions of 780 CMR 1304.1, 1304.3, and 1304.4, and the *envelope performance factor* of the proposed building is less than or equal to the *envelope performance factor* of the budget building. The *envelope performance factor* considers only the *building envelope* components. Schedules of operation, lighting power, equipment power, occupant density, and mechanical systems shall be the same for both the proposed building and the budget building. *Envelope performance factor* shall be calculated using computer programs accepted by the Board of Building Regulations and Standards.

780 CMR 1305.0 HEATING VENTILATION AND AIR CONDITIONING

1305.1 General. 780 CMR 1305.0 covers the design and construction of mechanical systems and equipment serving the building heating, cooling, or ventilating needs.

1305.1.1 Compliance. Compliance with 780 CMR 1305.0 shall be achieved by meeting either 780 CMR 1305.2 or 780 CMR 1305.3.

1305.2 Simple HVAC Systems and Equipment.

1305.2.1 Scope. 780 CMR 1305.2 applies to buildings served by unitary or packaged air conditioners or heat pumps, packaged terminal air conditioners, and packaged furnaces each serving one zone and controlled by a single thermostatic control in the zone served. It also applies to buildings served by packaged boilers and two-pipe heating systems serving one or more zones.

780 CMR 1305.2 does not apply to non-unitary or non-packaged HVAC equipment and systems or to chiller systems.

780 CMR 1305.2 does not apply to buildings in which the outside air quantity capable of being supplied by any individual fan system exceeds 3000 cfm or 70% of the total design supply air quantity for the fan system.

1305.2.2 Calculation of Heating and Cooling Loads. Design loads shall be determined in accordance with the procedures described in Chapters 25 and 26 of the ASHRAE 1997 Handbook of Fundamentals or an approved equivalent computation procedure.

1305.2.2.1 Equipment and System Sizing. Heating and cooling equipment and systems capacity shall not exceed the loads calculated in accordance with 780 CMR 1305.2.2. A single piece of equipment providing both heating and cooling shall satisfy this provision for one function with the capacity for the other function as small as possible, within available equipment options.

1305.2.3 HVAC Equipment Performance Requirements. Packaged air conditioners and heat pumps with capacity greater than 240,000 Btu/h, ground-source and ground water source heat pumps, and duct furnaces and unit heaters shall meet the minimum efficiency requirements of Tables 1305.3.3(1), (2), and (4), when tested and rated in accordance with the referenced test procedure. The efficiency shall be verified through data furnished by the manufacturer or through certification under an approved certification program. Where multiple rating conditions and/or performance requirements are provided, the equipment shall satisfy all stated requirements.

Other new equipment within the scope of 780 CMR 1305.2 is required to meet efficiency standards administered by the federal government. The efficiency of used equipment within the scope of the federal standards shall be verified through data furnished by the manufacturer.

Equipment not required to meet efficiency standards administered by the federal government, and not in Tables 1305.3.3(1), (2), and (4) may be used, and have no minimum performance requirements.

1305.2.4 Temperature and Humidity Controls:

1305.2.4.1 Temperature Controls. Each heating and cooling system shall have at least one programmable thermostat. The thermostat shall have the capability to setback or shutdown the system based on day of the week and time of day and a readily accessible manual override that will return to the pre-setback or shutdown schedule without reprogramming. Thermostatic controls shall be capable of providing a temperature range or dead band of at least 5°F within which the supply of heating and cooling energy to the zone is shut off or reduced to a minimum.

Exception. Thermostats requiring manual changeover between heating and cooling modes.

Where heating and cooling to a zone are controlled by separate zone thermostatic controls located within the zone, means (such as limit switches, mechanical stops, or, for *direct digital control* (DDC) systems, software programming) shall be provided to prevent the heating set point from exceeding the cooling set point minus any applicable proportional band.

Heat pumps having supplementary electric resistance heat shall have controls that, except during defrost, prevent supplemental heat operation when the heat pump can meet the heating load.

1305.2.4.2 Humidity Controls. When humidistats are installed they shall prevent the use of fossil fuel or electric power to achieve a humidity below 60% when the system controlled is cooling, and above 30% when the system controlled is heating.

1305.2.5 Hydronic System Controls. Hydronic heating systems of at least 300,000 Btu/h design capacity supplying heated water to comfort conditioning systems shall include controls that have the capability to automatically reset the supply water temperatures by representative building loads (including return water temperature) or by outside air temperature.

Exception. systems which vary water flow in compliance with 780 CMR 1305.3.5.4.

Hydronic heating systems comprised of multiple packaged boilers and designed to deliver conditioned water or steam into a common distribution system shall include automatic controls capable of sequencing operation of the boilers.

Hydronic heating systems comprised of a single boiler of greater than 500,000 Btu/h design capacity shall include either a multi-staged or modulating burner.

1305.2.6 Ventilation. Natural or mechanical ventilation shall be provided in accordance with the mechanical code listed in 780 CMR 35. Any mechanical ventilation system shall have the capability to reduce the outdoor air supply to the minimum required by the mechanical code listed in 780 CMR 35.

1305.2.6.1 Distributed Fan Systems. Where mechanical ventilation is provided by multiple fan systems located in a plenum or other enclosed space, outdoor air shall be ducted directly to each individual fan system.

1305.2.6.2 Shutoff Dampers. Outdoor air supply ducts and exhaust ducts associated with the mechanical ventilation system shall be provided with automatic means to reduce and shutoff air flow.

Exceptions:

1. Systems serving areas designed for continuous operation .
2. Individual systems with an outside air intake or exhaust capacity of 300 cfm or less.
3. Systems with readily accessible manual dampers.

1305.2.7 Economizers. Each system over 65,000 Btu/h cooling capacity shall have an economizer that will automatically shut off the cooling system and allow 100% of the supply air to be outdoor air.

1305.2.8 Duct and Plenum Insulation and Sealing. All supply and return air ducts and plenums shall be insulated with a minimum of R-5 insulation when located in *unconditioned spaces* and with a minimum of R-8 insulation when located outside the building envelope. When located within a building envelope assembly the duct or plenum shall be separated from the building exterior or unconditioned or exempt spaces by a minimum R-5 insulation. Required R-values are the "labeled" R-values for such ducts.

Exceptions:

1. When located within equipment.
2. When the design temperature difference between the interior and exterior of the duct or plenum does not exceed 15°F.
3. Exhaust air ducts.
4. Outside air supply ducts located outside of the building envelope.

All joints, longitudinal and transverse seams, and connections in duct work, shall be securely fastened and sealed with welds, gaskets, mastics (adhesives), mastic-plus-embedded-fabric systems, or tapes. Tapes and mastics used with rigid fibrous glass ducts shall be listed and labeled in accordance with UL 181A. Tapes and mastics used with flexible air ducts shall be listed and labeled in accordance with UL 181B. Duct tape is not permitted as a sealant on any metal ducts.

1305.2.9 Piping Insulation. All low pressure side refrigerant piping shall be insulated with ¾ in. of insulation, hot water piping for comfort conditioning shall be insulated with one inch of insulation, and steam system piping shall be insulated with two inches of insulation. All insulation shall have a conductivity not exceeding 0.27 Btu-in./hr-ft^2 °F.

1305.3 Complex HVAC Systems and Equipment:

1305.3.1 Scope. 780 CMR 1305.3 applies to all HVAC systems and equipment other than those covered in 780 CMR 1305.2.

1305.3.2 Calculation of Heating and Cooling Loads. Design loads shall be determined in accordance with the procedures described in Chapters 25 and 26 of the *ASHRAE Handbook of Fundamentals*. Heating and cooling loads shall be adjusted to account for load reductions that are achieved when energy recovery systems are utilized in the HVAC system in accordance with the *ASHRAE HVAC Systems and Equipment Handbook*. Alternatively, design loads shall be determined by an approved equivalent computation procedure.

1305.3.2.1 Equipment and System Sizing. Heating and cooling equipment and system capacity shall not exceed the loads calculated in accordance with 780 CMR 1305.3.2.

1305.3.3 HVAC Equipment Performance Requirements. Equipment shall be newly purchased or shall meet the minimum efficiency requirements of Tables 1305.3.3(1) through 1305.3.3(11), as applicable, when tested and rated in accordance with the referenced test procedure. The efficiency shall be verified through data furnished by the manufacturer or through an approved certification program. Where multiple rating conditions and/or performance requirements are provided, the equipment shall satisfy all stated requirements.

Certain new equipment within the scope of 780 CMR 1305.3.3 is required to meet efficiency standards administered by the federal government. The efficiency of used equipment within the scope of the federal standards shall be verified through data furnished by the manufacturer.

Equipment not required to meet efficiency standards administered by the federal government, and not in Tables 1305.3.3(1) through 1305.3.3(11) may be used, and have no minimum performance requirements.

1305.3.3.1 Duct furnaces and Unit Heaters. Warm air duct furnaces and unit heaters shall have an intermittent ignition device, maximum jacket losses of 0.75% of the equipment input rating, and power venting or a flue damper. When combustion air is drawn from the conditioned space a vent damper shall be permitted to be used in lieu of the required flue damper.

TABLE 1305.3.3(1) UNITARY AIR CONDITIONERS AND CONDENSING UNITS, ELECTRICALLY OPERATED, MINIMUM EFFICIENCY REQUIREMENTS

Equipment Type	Size Category	Sub-Category or Rating Condition	Minimum Efficiency[b]	Test Procedure[a]
Air Conditioners, Air Cooled	<65,000 Btu/h[d]	Split system	10.0 SEER	ARI 210/240
		Single package	9.7 SEER	
	≥65,000 Btu/h and <135,000 Btu/h	Split system and single package	10.3 EER[c]	
	≥135,000 Btu/h and <240,000 Btu/h	Split system and single package	9.7 EER[c]	ARI 340/360
	≥ 240,000 Btu/h and < 760,000 Btu/h	Split System and Single Package	9.5 EER[c] 9.7 IPLV[b]	
	> 760,000 Btu/h	Split System and Single Package	9.2 EER[c] 9.4 IPLV[c]	
Air Conditioners, Water and Evaporatively Cooled	<65,000 Btu/h	Split System and Single Package	12.1 EER[b]	ARI 210/240
	≥65,000 Btu/h and <135,000Btu/h	Split system and single package	11.5 EER[c]	
	≥ 135,000 Btu/h and < 240,000 Btu/h	Split System and Single Package	11.0 EER[c]	ARI 340/360
	≥ 240,000 Btu/h	Split System and Single Package	11.0 EER[c] 13.1 IPLV[c]	

For SI: 1 British thermal unit per hour - 0.2931 W.

a. The IECC contains a complete specification of the referenced test procedure, including the references year version of the test procedure

b. IPLVs are only applicable to equipment with capacity modulation.

c. Deduct 0.2 from the required EERs and IPLVs for units with a heating section other than electric resistance heat.

d. Single-phase air-cooled air conditioners <65,000 Btu/h are regulated by the National Appliance Energy Conservation Act of 1987 (NAECA), SEER values are those set by NAECA.

TABLE 1305.3.3(2) UNITARY AND APPLIED HEAT PUMPS, ELECTRICALLY OPERATED, MINIMUM EFFICIENCY REQUIREMENTS

Equipment Type	Size Category	Sub-Category or Rating Condition	Minimum Efficiency[b]	Test Procedure[a]
Air Cooled, (Cooling Mode)	<65,000 Btu/h[d]	Split System	10.0 SEER	ARI 210/240
		Single Package	9.7 SEER	
	≥65,000 Btu/h and <135,000 Btu/h	Split System and Single Package	10.1 EER[c]	
	≥135,000 Btu/h and <240,000 Btu/h	Split System and Single Package	9.3 EER[c]	ARI 340/360
	≥ 240,000 Btu/h	Split System and Single Package	9.0 EER[b] 9.2 IPLV[b]	
Water source (Cooling mode)	<17,000 Btu/h	86°F entering water	11.2 EER	ARI/ASHRAE-13256-1
	≥17,000 Btu/h and <135,000 Btu/h	86°F entering water	12.0 EER	ARI/ASHRAE-13256-1
Groundwater- Source (Cooling Mode)	< 135,000 Btu/h	59°F Entering water	16.2 EER	ARI/ASHRAE 13256-1
Ground Source (Cooling Mode)	< 135,000 Btu/h	77°F Entering water	13.4 EER	ARI/ASHRAE 13256-1
Air Cooled, (Heating Mode)	<65,000 Btu/h[d] (Cooling capacity)	Split System	6.8 HSPF	ARI 210/240
		Single Package	6.6 HSPF	
	≥65,000 Btu/h and <135,000 Btu/h (Cooling capacity)	47°F db/43° wb outdoor air	3.2 COP	
	≥135,000 Btu/h (Cooling capacity)	47°F db/43° wb outdoor air	3.1 COP	ARI 340/360
Water source (Heating mode)	<135,000 Btu/h (Cooling capacity)	68°F entering water	4.2 COP	ARI/ASHRAE 13256-1
Groundwater- Source (Heating Mode)	< 135,000 Btu/h (Cooling Capacity)	50°F Entering Water	3.6 COP	ARI/ASHRAE 13256-1
Ground Source (Heating Mode)	< 135,000 Btu/h (Cooling Capacity)	32°F Entering Water	3.1 COP	ARI/ASHRAE 13256-1

For SI: °C = [(°F - 32]/1.8, 1 British thermal unit per hour - 0.2931 W.

db - dry-bulb temperature, °F wb - wet-bulb temperature, °F

a. The IECC contains a complete specification of the referenced test procedure, including the references year version of the test procedure

b. IPLVs and Part load rating conditions are only applicable to equipment with capacity modulation.

c. Deduct 0.2 from the required EERs and IPLVs for units with a heating section other than electric resistance heat.

d. Single-phase air-cooled air conditioners <65,000 Btu/h are regulated by the National Appliance Energy Conservation Act of 1987 (NAECA), SEER values are those set by NAECA.

TABLE 1305.3.3(3) PACKAGED TERMINAL AIR CONDITIONERS AND PACKAGED TERMINAL HEAT PUMPS

Equipment Type	Size Category (Input)	Sub-Category or Rating Condition	Minimum Efficiency[b]	Test Procedure[a]
PTAC (Cooling mode) New Construction	All capacities	95°F db outdoor air	12.5 - (0.213 • Cap/1000 EER	ARI 310/380
PTAC (Cooling mode) Replacements[c]	All capacities	95°F db outdoor air	10.9 - (0.213 • Cap/1000 EER	
PTHP (Cooling mode) New Construction	All capacities	95°F db outdoor air	12.3 - (0.213 • Cap/1000 EER	
PTHP (Cooling mode) Replacements	All capacities	95°F db outdoor air	10.8 - (0.213 • Cap/1000 EER	
PTHP (Cooling mode) New Construction	All capacities	-	3.2 - (0.026 • Cap/1000 COP	
PTHP (Cooling mode) Replacements	All capacities	-	2.9 - (0.026 • Cap/1000 COP	

For SI: °C = [(°F - 32]/1.8, 1 British thermal unit per hour - 0.2931 W.

db - dry-bulb temperature, °F wb - wet-bulb temperature, °F

a. The IECC contains a complete specification of the referenced test procedure, including the references year version of the test procedure

b. Cap means the rated cooling capacity of the product in Btu/h. If the unit's capacity is less than 7,000 Btu/h, use 7,000 Btu/h in the calculation. If the unit's capacity os greater than 15,000 Btu/h, use 15,000 Btu/h in the calculation.

c. Replacement units must be factory labeled as follows: "MANUFACTURED FOR REPLACEMENT APPLICATIONS ONLY: NOT TO BE INSTALLED IN NEW CONSTRUCTION PROJECTS." Replacement efficiencies apply only to units with existing sleeves less than 16 inches (406 mm) high and less than 42 inches (1067 mm) wide.

TABLE 1305.3.3(4) WARM AIR FURNACES AND COMBINATION WARM AIR FURNACES/AIR-CONDITIONING UNITS, WARM AIR DUCT FURNACES AND UNIT HEATERS, MINIMUM EFFICIENCY REQUIREMENTS

Equipment Type	Size Category (Input)	Sub-Category or Rating Condition[a]	Minimum Efficiency[d,e]	Test Procedure[a]
Warm Air Furnaces, Gas-Fired	< 225,000 Btu/h	-	78% AFUE or 80% E_t[c]	DOE 10 CFR Part 430 or ANSI Z21.47
	≥ 225,000 Btu/h	Maximum Capacity[c]	80% E_t[c]	ANSI Z21.47
Warm Furnaces, Oil-Fired	< 225,000 Btu/h	-	78% AFUE or 80% E_t[c]	DOE 10 CFR Part 430 or UL 727
	≥ 225,000 Btu/h	Maximum Capacity[b]	81% E_t[c]	UL 727
Warm Air Duct Furnaces, Gas-Fired	All Capacities	Maximum Capacity[b]	80% E_c	ANSI Z83.8
Warm Air Unit Heaters, Gas-Fired	All Capacities	Maximum Capacity[b]	80% E_c	ANSI Z83.8
Warm Air Unit Heaters, Oil-Fired	All Capacities	Maximum Capacity[b]	80% E_c	UL 731

For SI: °C = [(°F - 32]/1.8, 1 British thermal unit per hour - 0.2931 W.

a. The IECC contains a complete specification of the referenced test procedure, including the references year version of the test procedure

b. Minimum and maximum ratings as provided for and allowed by the unit's controls

c. Combination units not covered by the National Appliance Energy Conservation Act of 1987 (NAECA) (3-phase power or cooling capacity greater than oor equal to 65,000 Btu/h [19 kW] shall comply with either rating.

d. E_t = Thermal efficiency. See test procedure for detailed discussion.

e. E_c = Combustion efficiency (100% less flue losses). See test procedure for detailed discussion.

f. E_t = Combination efficiency. Units must also include an IID, have jackets not exceeding 0.75% of the input rating, and have either power venting or a flue damper. A vent damper is an acceptable alternative to a flue damper for those furnaces where combustion air is drawn from the conditioned space.

g. E_t = Thermal efficiency. Units must also include an IID, have jacketed loses not exceeding 0.75% of the input rating, and have either power venting or a flue damper. A vent damper is an acceptable alternative to a flue damper for those furnaces where combustion air is drawn from the conditioned space.

TABLE 1305.3.3(5) BOILERS, GAS- AND OIL-FIRED, MINIMUM EFFICIENCY REQUIREMENTS

Equipment Type	Size Category	Sub-Category or Rating Condition	Minimum Efficiency[c, d, e]	Test Procedure[a]
Boilers, Gas-Fired	< 300,000 Btu/h	Hot water	80% AFUE	DOE 10 CFR Part 430
		Steam	75% AFUE	
	≥ 300,000 Btu/h and ≤ 2,500,000 Btu/h	Minimum Capacity[b]	75% E_t	H.I. HBS
	> 2,500,000 Btu/h	Hot Water	80% E_c	
		Steam	80% E_c	
Boilers, Oil-Fired	< 300,000 Btu/h	-	80% AFUE	DOE 10 CFR Part 430
	≥ 300,000 Btu/h and ≤ 2,500,000 Btu/h	Minimum Capacity[b]	78% E_t	H.I. HBS
	> 2,500,000 Btu/h	Hot Water	83% E_c	
		Steam	83% E_c	
Oil-Fired (Residual)	≥ 300,000 Btu/h and ≥ 2,500,000 Btu/h	Minimum Capacity[a]	83% E_c	H.I. HBS
	> 2,500,000 Btu/h[f]	Hot Water	83% E_c	
		Steam	83% E_c	

For SI: 1 British thermal unit per hour - 0.2931 W.

a. The IECC contains a complete specification of the references test procedure, including the references year version of the test procedure.

b. Minimum ratings as provided for and allowed by the unit's controls.

c. E_c = Combustion efficiency (100% flue losses). See reference document for detailed information.

d. E_t = Thermal efficiency. See reference document for detailed information.

e. Alternate test procedures used at the manufacturer's option are ASME PTC-4.1 for units over 5,000,000 Btu/h input, or ANSI Z21.13 for units greater than or equal to 300,000 Btu/h and less than or equal to 2,500,000 Btu/h input.

f. These requirements apply to boilers with rated input of 8,000,000 Btu/h or less that are not packaged boilers, and to all packaged boilers. Minimum efficiency requirements for boilers cover all capacities of packaged boilers.

TABLE 1305.3.3(6) CONDENSING UNITS, ELECTRICALLY OPERATED, MINIMUM EFFICIENCY REQUIREMENTS

Equipment Type	Size Category	Minimum Efficiency[b]	Test Procedure[a]
Condensing Units, Air cooled	≥ 135,000 Btu/h	10.1 EER 11.2 IPLV	ARI 365
Condensing Units, Water or evaporatively cooled	≥ 135,000 Btu/h	13.1 EER 13.1 IPLV	

For SI: 1 British thermal unit per hour - 0.2931 W.

a. The IECC contains a complete specification of the references test procedure, including the references year version of the test procedure.

b. IPLVs are only applicable to equipment with capacity modulation.

TABLE 1305.3.3(7) WATER CHILLING PACKAGES, MINIMUM EFFICIENCY REQUIREMENTS

Equipment Type	Size Category	Minimum Efficiency[b]	Test Procedure[a]
Air Cooled, With Condenser, Electrically Operated	< 150 Tons	2.80 COP 2.80 IPLV	ARI 550/590
	≥ 150 Tons	2.50 COP 2.50 IPLV	
Air Cooled, Without Condenser, Electrically Operated	All Capacities	3.10 COP 3.10 IPLV	ARI 550/590
Water Cooled, Electrically Operated, Positive Displacement (Reciprocating)	All Capacities	4.20 COP 4.65 IPLV	
Water Cooled, Electrically Operated, Positive Displacement (Rotary Screw and Scroll)	< 150 Tons	4.45 COP 4.50 IPLV	ARI 550/590
	≥ 150 Tons and < 300 Tons	4.90 COP 4.95 IPLV	
	≥ 300 Tons	5.50 COP 5.60 IPLV	
Water Cooled, Electrically Operated, Centrifugal	< 150 Tons	5.00 COP 5.00 IPLV	ARI 550/590
	≥ 150 Tons and < 300 Tons	5.55 COP 5.55 IPLV	
	≥ 300 Tons	6.10 COP 6.10 IPLV	
Air Cooled Absorption Single Effect	All Capacities	0.60 COP	ARI 560
Water Cooled Absorption Single Effect	All Capacities	0.70 COP	
Absorption Double Effect, Indirect-Fired	All Capacities	1.00 COP 1.05 IPLV	
Absorption Double Effect, Direct-Fired	All Capacities	1.00 COP 1.00 IPLV	

For SI: 1 ton = 3.517 kW. °C - [(°F) - 32]/1.8.

For SI: 1 British thermal unit per hour - 0.2931 W.

a. The IECC contains a complete specification of the references test procedure, including the references year version of the test procedure.

b. The chiller equipment requirements do not apply for chillers used in low temperature applications where the design leaving fluid temperature is less than or equal to 40°F.

TABLE 1305.3.3(8) COPS AND IPLVS FOR NONSTANDARD CENTRIFUGAL CHILLERS < 150 TONS

CENTRIFUGAL CHILLERS , 150 Tons $COP_{std} = 5.4$								
Leaving chilled water temperature (°F)	Entering condenser water temperature (°F)	Lift[a]	Condenser flow rate					
			2 gpm/ton	2.5 gpm/ton	3 gpm/ton	4 gpm/ton	5 gpm/ton	6 gpm/ton
			Required COP and IPLV					
46	75	29	6.00	6.27	6.48	6.80	7.03	7.20
45	75	30	5.92	6.17	6.37	6.66	6.87	7.02
44	75	31	5.84	6.08	6.26	6.53	6.71	6.86
43	75	32	5.75	5.99	6.16	6.40	6.58	6.71
42	75	33	5.67	5.90	6.06	5.29	6.45	6.57
41	75	34	5.59	5.82	5.98	6.19	6.34	6.44
46	80	34	5.59	5.82	5.98	6.19	6.34	6.44
40	75	35	5.50	5.74	5.89	6.10	6.23	6.33
45	80	35	5.50	5.74	5.89	6.10	6.23	6.33
44	80	36	5.41	5.66	5.81	6.01	6.13	6.22
43	80	37	5.31	5.57	5.73	5.92	6.04	6.13
42	80	38	5.21	5.48	5.64	5.84	5.95	6.04
41	80	39	5.09	5.39	5.56	7.76	5.87	5.95
46	85	39	5.09	5.39	5.56	5.76	5.87	5.95
40	80	40	4.96	5.29	5.47	5.67	5.79	5.86
45	85	40	4.96	5.29	5.47	5.67	5.79	5.86
44	85	41	4.83	5.18	5.40	5.59	5.71	5 78
43	85	42	4.68	5 07	5.28	5.50	5.62	5.70
42	85	43	4.51	4.94	5.17	5.41	5.54	5.62
41	85	44	4.33	4.80	5.05	5.31	5.45	5.53
40	85	45	4.13	4.65	4.92	5.21	5.35	5 44
Condenser ΔT[b]			14.04	11.23	9.36	7.02	5.62	4.68

For SI: °C - [(°F) - 32]/1.8, 1 gallon per minute - 3.785L/min., 1 ton - 12,000 British thermal unit per hour - 3,517 kW.

a. Lift - Entering condenser water temperature (°F) - Leaving chilled water temperature (°F).

b. Condenser ΔT - Leaving condenser water temperature (°F) - Entering condenser water temperature (°F).

$K_{adj} - 6.1507 - 0.30244(x) + 0.0062692(x)^2 - 0.000045595(x)$
where: x - Condenser ΔT + Lift
$COP_{adj} - K_{adj}x - COP_{std}$

TABLE 1305.3.3(9) COPS AND IPLVS FOR NONSTANDARD CENTRIFUGAL CHILLERS ≥ 150 TONS ≤ 300 TONS

CENTRIFUGAL CHILLERS ,≥ 150 TONS ≤ 300 TONS COP_{std}= 5.55								
Leaving chilled water temperature (°F)	Entering condenser water temperature (°F)	Lift[a]	Condenser flow rate					
			2 gpm/ton	2.5 gpm/ton	3 gpm/ton	4 gpm/ton	5 gpm/ton	6 gpm/ton
			Required COP and IPLV					
46	75	29	6.17	6.44	6.66	6.99	7.23	7.40
45	75	30	6.08	6.34	6.54	6.84	7.06	7.22
44	75	31	6.00	6.24	6.43	6.71	6.90	7.05
43	75	32	5.91	6.15	6.33	6.58	6.76	6.89
42	75	33	5.83	6.07	6.23	6.47	6.63	6.75
41	75	34	5.74	5.98	6.14	6.36	6.51	6.62
46	80	34	5.74	5.98	6.14	6.36	6.51	6.62
40	75	35	5.65	5.90	6.05	6.26	6.40	6.51
45	80	35	5.65	5.90	6.05	6.26	6.40	6.51
44	80	36	5.56	5.81	5.97	6.17	6.30	6.40
43	80	37	5.46	5.73	5.89	6.08	6.21	6.30
42	80	38	5.35	5064	5.8	6.00	6.12	6.20
41	80	39	5.23	5.54	5.71	5.91	6.13	6.11
46	85	39	5.23	5.54	7.71	5.91	6.03	6.11
40	80	40	5.10	5.44	5.62	5.83	5.95	6.03
45	85	40	5.10	5.44	5.62	5.83	5.95	6 03
44	85	41	4.96	5.33	5.55	5.74	5.86	5.94
43	85	42	4.81	5.21	5.42	5.66	5.78	5.86
42	85	43	4.63	5.08	5.31	5.56	5.69	5.77
41	85	44	4.45	4.93	5.19	5.46	5.60	5.69
40	85	45	4.24	4.77	5.06	5.35	5.50	5.59
Condenser ΔT[b]			1.4.04	11.23	9.36	7.02	5.62	4.68

For SI: °C - [(°F) - 32]/1.8, 1 gallon per minute - 3.785L/min., 1 ton - 12,000 British thermal unit per hour - 3,517 kW.

a. Lift - Entering condenser water temperature (°F) - Leaving chilled water temperature (°F).

b. Condenser ΔT - Leaving condenser water temperature (°F) - Entering condenser water temperature (°F).

K_{adj} - 6.1507 - 0.30244(x) + 0.0062692$(x)^2$ - 0.000045595(x)
where: x - Condenser ΔT + Lift COP_{adj} - K_{adj}x - COP_{std}

TABLE 1305.3.3(10) COPS AND IPLVS FOR NONSTANDARD CENTRIFUGAL CHILLERS > 300 TONS

CENTRIFUGAL CHILLERS ,> 300Tons COP_{std}= 6.1								
Leaving chilled water temperature (°F)	Entering condenser water temperature (°F)	Lift[a]	**Condenser flow rate**					
			2 gpm/ton	2.5 gpm/ton	3 gpm/ton	4 gpm/ton	5 gpm/ton	6 gpm/ton
			Required COP and IPLV					
46	75	29	6.80	7.11	7.35	7.71	7.97	8.16
45	75	30	6.71	6.99	7.21	7..55	7.78	7.96
44	75	31	6.61	6.89	7.09	7.40	7.61	7.77
43	75	32	6.52	6.79	6.98	7.26	7.45	7.60
42	75	33	6.43	6.69	6.87	7.13	7.31	7.44
41	75	34	6.33	6.60	6.77	7 02	7.18	7.30
46	80	34	6.33	6.60	6.77	7 02	7.18	7 30
40	75	35	6.23	6.50	6.68	6.91	7.06	7.17
45	80	35	6.23	6.50	6.68	6.91	7.06	7.17
44	80	36	6.13	6.41	6.58	6 81	6.95	7.05
43	80	37	6.02	6.31	6.49	6.71	6.85	6.94
42	80	38	5.90	6.21	6.40	6.61	6.75	6.84
41	80	39	5.77	6.11	6.30	6.52	6.65	6.74
46	85	39	5.77	6.11	6.30	6.52	6.65	6.74
40	80	40	5.63	6.00	6.20	6.43	6.56	6.65
45	85	40	5.63	6.00	6.20	6.43	6.56	6.65
44	85	41	5.47	5.87	6.10	6.33	6.47	6.55
43	85	42	5.30	5.74	5.98	6.24	6.37	6.46
42	85	43	5.11	5.60	5.86	6.13	6.28	6.37
41	85	44	4.90	5.44	5.72	6.02	6.17	6.27
40	85	45	5.68	5.26	5.58	5.90	6 07	6.17
Condenser ΔT[b]			14.04	11.23	9.36	7.02	5.62	4.68

For SI: °C - [(°F) - 32]/1.8, 1 gallon per minute - 3.785L/min., 1 ton - 12,000 British thermal unit per hour - 3,517 kW.

a. Lift - Entering condenser water temperature (°F) - Leaving chilled water temperature (°F).

b. Condenser ΔT - Leaving condenser water temperature (°F) - Entering condenser water temperature (°F).

$K_{adj} - 6.1507 - 0.30244(x) + 0.0062692(x)^2 - 0.000045595(x)$

where: x - Condenser ΔT + Lift

$COP_{adj} - K_{adj}x - COP_{std}$

TABLE 1305.3.3(11) PERFORMANCE REQUIREMENTS FOR HEAT REJECTION EQUIPMENT

Equipment Type	Total System Heat Rejection Capacity at Rated Conditions	Sub-Category or Rating Condition	Performance Required[a, b]	Test Procedure[c]
Propeller or Axial Fan Cooling Towers	All	95 °F Entering Water 85°F Leaving Water 75°F wb Outdoor Air	≥ 38.2 gpm/hp	CTI ATC-105
Centrifugal Fan Cooling Towers	All	95 °F Entering Water 85°F Leaving Water 75°F wb Outdoor Air	≥ 20.0 gpm/hp	CTI ATC-105
Air Cooled Condensers	All	125 °F Condensing Temperature R22 Test Fluid 190°F Entering Gas Temperature 15°F Subcooling 95°F Entering Drybulb	≥ 176,000 Btu/h •hp (69 COP)	ARI 460

For SI: °C = [(°F - 32]/1.8, 1 British thermal unit per hour - 0.2931 W; 1 gallon per minute per horsepower = 0.846 L/s • kW.

wb - wet-bulb temperature, °F

a. For purposes of this table, cooling tower performances is defined as the maximum flow rating of the tower units (gpm) divided by the fan nameplate rated motor power units (hp).

b. For purposes of this table, air cooled condenser performance is defined as the heat rejected from the refrigerant units (Btu/h) divided by the fan nameplate rated motor power units (hp).

c, The IECC contains a complete specification of the referenced test procedure, including the references year version of the test procedure

1305.3.4 Temperature and Humidity Controls.

1305.3.4.1 Thermostatic Controls. The supply of heating and cooling energy to each zone shall be individually controlled by thermostatic controls capable of responding to temperature within the zone.

Exception. Independent perimeter systems that are designed to offset only building envelope heat losses and/or gains serving one or more zones also served by an interior system provided:

1. the perimeter system includes at least one thermostatic control zone for each building exposure of the building (face within +/- 45°) having exterior walls facing only one orientation for more than 50 contiguous feet and,
2. the perimeter system heating and cooling supply is controlled by thermostatic controls located within the zone(s) served by the system.

1305.3.4.2 Zone Thermostatic Control capabilities:

1305.3.4.2.1 Set Point Overlap Restriction. Where used to control both heating and cooling, zone thermostatic controls shall be capable of providing a temperature range or dead band of at least 5°F within which the supply of heating and cooling energy to the zone is shut off or reduced to a minimum.

Exception. Thermostats requiring manual changeover between heating and cooling modes.

Where heating and cooling to a zone are controlled by separate zone thermostatic controls located within the zone, means (such as limit switches, mechanical stops, or, for *direct digital control* (DDC) systems, software programming) shall be provided to prevent the heating set point from exceeding the cooling set point minus any applicable proportional band.

1305.3.4.2.2 Off-hour Controls. HVAC systems shall have setback and automatic controls.

Exceptions:

1. Systems that serve areas that operate continuously, or
2. Systems with full load demands not exceeding 2 kW when having a readily accessible manual shut off switch.

Thermostatic setback controls shall have the capability to setback or temporarily operate the system to maintain zone temperatures down to 55 °F or up to 85 °F.

HVAC systems shall be equipped with an automatic timeclock or programmable control that is capable of starting and stopping the system for seven different daily schedules per week, retaining programming and time setting during loss of power for a period of at least ten hours, and has a manual override that allows temporary operation of the system for up to two hours; a manually-operated timer capable of being adjusted to operate the system for up to two hours; or an occupancy sensor.

1305.3.4.3 Zone Isolation. Systems that serve zones that will have the capability to operate non- simultaneously shall include isolation devices and controls to shut off or set back the supply of ventilation air, heating, and cooling to each zone independently. For offices, each isolation area shall be no larger than 25,000 ft^2 of conditioned floor area nor include more than one floor. For all other occupancies, isolation areas shall be no larger than a single *zone*, a single tenant space, or 5000 ft^2 of conditioned floor area, whichever is larger.

Exception. Exhaust air and outside air connections to fan systems of 5,000 cfm and smaller.

1305.3.4.4 Humidifier Preheat. Humidifiers with preheating jackets mounted in the air stream shall be provided with an automatic valve to shut off preheat when humidification is not required.

1305.3.4.5 Humidification and Dehumidification. Where a *zone* is served by a system or systems with both humidification and dehumidification capability, means (such as limit switches, mechanical stops, or, for *direct digital control* (DDC) systems, software programming) shall be capable of preventing simultaneous operation of humidification and dehumidification equipment.

Exceptions:

1. Zones served by desiccant systems, used with direct evaporative cooling in series.
2. Systems serving zones where specific humidity levels are required, such as computer rooms, museums, and hospitals.

1305.3.4.6 Simultaneous Heating and Cooling. Zone thermostatic and humidistatic controls shall be capable of operating in sequence the supply of heating and cooling energy to the zone. Controls shall be capable of preventing reheating; recooling; mixing, or simultaneously supplying air that has been previously mechanically heated and air that has been previously cooled either by economizer operation or mechanical cooling.

Exceptions:

1. Variable air volume systems which, during periods of occupancy, are designed to reduce the primary air supply to each zone to a minimum before reheating, recooling, or mixing takes place.
2. Zones where special pressurization relationships or cross-contamination requirements are such that variable air volume systems are impractical.
3. At least 75% of the energy for reheating or for providing warm air in mixing systems is provided from a site-recovered or site-solar energy source.
4. Zones where special humidity levels are required to satisfy process needs.
5. Zones with a peak supply air quantity of 300 cfm or less and where the flow rate is less than 10% of the total fan system flow rate.
6. Zones where the volume of air to be reheated, recooled, or mixed is no greater than the volume of outside air required to meet the minimum ventilation requirements of 780 CMR 1305.3.6.

1305.3.4.7 Temperature Reset for Air Systems. Air systems supplying heated or cooled air to multiple zones shall include controls that have the capability to automatically reset the supply air in response to measured parameters representative of building loads or by outside air temperature. Temperature shall be capable of being reset by at least 25% of the design supply air to room air temperature difference.

Exception. Systems that comply with 780 CMR 1305.3.4.6 without using Exception 1., 2. or 6.

1305.3.5 Hydronic System Controls. The heating of fluids that have been previously mechanically cooled and the cooling of fluids that have been previously mechanically heated shall be limited in accordance with 780 CMR 1305.3.5.1 through 1305.3.5.3.

Hydronic heating systems comprised of multiple packaged boilers and designed to deliver conditioned water or steam into a common distribution system shall include automatic controls capable of sequencing operation of the boilers.

Hydronic heating systems comprised of a single boiler and greater than 500,000 Btu/h design capacity shall include either a multi-staged or modulating burner.

1305.3.5.1 Three-pipe System. Hydronic systems that use a common return system for both hot water and chilled water are prohibited.

1305.3.5.2 Two-pipe Changeover System. Systems that use a common distribution system to supply both heated and chilled water shall. be designed to allow a dead band between changeover from one mode to the other of at least 15°F outside air temperature; be designed to and provided with controls that will allow operation in one mode for at least four hours before changing over to the other mode; and be provided with controls that allow heating and cooling supply temperatures at the changeover point to be no more than 30°F apart.

1305.3.5.3 Hydronic (Water Loop) Heat Pump Systems. Hydronic heat pumps connected to a common heat pump water loop with central devices for heat rejection and heat addition shall have controls that are capable of providing a heat pump water supply temperature dead band of at least 20°F between initiation of heat rejection and heat addition by the central devices. If a closed-circuit cooling tower is used, either an automatic valve shall be installed to bypass all but a minimal flow of water around the tower, or low leakage positive closure dampers shall be provided. If an open-circuit cooling tower is used directly in the heat pump loop, an automatic valve shall be installed to bypass all heat pump water flow around the tower. If an open-circuit cooling tower is used in conjunction with a separate heat exchanger to isolate the cooling tower from the heat pump loop, then heat loss shall be controlled by shutting down the circulation pump on the cooling tower loop. Each hydronic heat pump on the hydronic system having a total pump system power exceeding ten hp shall have a two-position valve.

Exception. Where a system loop temperature optimization controller is installed and can determine the most efficient operating temperature based on real time conditions of demand and capacity, dead bands of less than 20°F shall be permitted.

1305.3.5.4 Hydronic Variable Flow Systems. HVAC pumping systems that include control valves designed to modulate or step open and closed as a function of load shall be designed for variable fluid flow and be capable of reducing pump flow rates to 50% or less of the design flow rate.

1305.3.5.5 Maximum Power Use. Individual pumps serving variable flow systems having pump motors greater than 50 hp shall include controls that are capable of limiting pump motor demand to no more than 30% of design power input at 50% of design water flow.

1305.3.6 Ventilation. Ventilation, either natural or mechanical, shall be provided in accordance with the mechanical code listed in 780 CMR 35.00. Where mechanical ventilation is provided the system shall provide the capability to reduce the outdoor air supply to the minimum required by the mechanical code listed in 780 CMR 35.00.

1305.3.6.1 System Controls. Mechanical ventilation systems shall be provided with manual or automatic controls that will allow the fan system to operate whenever the spaces served are occupied. Air conditioning systems that supply required ventilation air shall be provided with controls designed to automatically maintain the required outdoor air supply rate during occupancy.

1305.3.6.2 Ventilation Controls for High-Occupancy Areas. Systems with design outside air capacities greater than 3000 cfm serving areas having an average design occupancy density exceeding 100 people per 1000 ft^2 shall include means to automatically reduce outside air intake below design rates when spaces are partially occupied. Ventilation controls shall be in compliance with the mechanical code listed in 780 CMR 35.

Exception. fan systems with energy recovery.

1305.3.6.3 Distributed Fan Systems. Where mechanical ventilation is provided by multiple fan systems located in a plenum or other enclosed space, outdoor air shall be ducted directly to each individual fan system.

1305.3.6.4 Outdoor Air Intake Control. Variable air volume systems shall have controls that are capable of maintaining total system outdoor airflow at not less than 90% of the outdoor air supply rates required by 780 CMR 1305.3.6.

1305.3.6.5 Zone Minimum Air Flow. Variable air volume zone controls shall maintain the hourly average outdoor supply air rate at not less than the minimum supply rate required by 780 CMR 1305.3.6 under any thermal load condition expected to occur when the spaces served are occupied.

1305.3.6.6 Shutoff Damper Controls. Both outdoor air supply and exhaust ducts associated with the mechanical ventilation system shall be equipped with motorized dampers that will automatically shut when the systems or spaces served are not in use.

Exceptions:

1. Gravity (non-motorized) dampers installed in buildings less than three stories in height above grade.
2. Individual supply systems with an outside air intake or exhaust capacity of 300 cfm or less.

1305.3.7 Economizers. Each cooling system including the fan with a total cooling capacity of at least 65,000 Btu/h shall have an air or water economizer.

Cooling fan systems with a total cooling capacity less than 65,000 Btu/hr shall have an air or water economizer in buildings three stories and taller where the total cooling capacity of all such systems exceeds 2,400,000 Btu/h or 10% of the total installed cooling capacity, whichever is larger.

Exceptions:

1. Systems that include gas phase air cleaning in order to meet ventilation requirements.
2. Where more than 25% of the air designed to be supplied by the system is to spaces that are designed to be humidified above a 35°F (2°C) dewpoint temperature in order to satisfy process needs.

3. Systems that include a condenser heat recovery system complying with 780 CMR 1305.3.12.
4. Systems that serve residential spaces where the system capacity is less than 325,000 cfm.
5. Systems that serve spaces whose sensible cooling load at design conditions, excluding transmission and infiltration loads, is less than or equal to transmission and infiltration losses at an outdoor temperature of 60°F.
6. Systems expected to operate less than 20 hours per week.
7. Where the use of outdoor air for cooling will affect supermarket open refrigerated casework systems.

1305.3.7.1 Air Economizers. Air economizers shall be designed to modulate outside air and return air dampers to provide up to the design supply air quantity as outside air.

Economizer dampers shall be capable of being sequenced with the mechanical cooling equipment and shall be controlled by other than mixed air temperature alone. The use of mixed air temperature limit control shall be permitted for systems controlled from space temperature (such as single-*zone* systems).

Air economizers shall be designed to automatically reduce the minimum supply of outside air to the minimum quantities required by 780 CMR 1305.3.6 when the use of outside air will no longer reduce cooling energy usage. Means shall be provided to relieve or exhaust excess return air during air economizer operation. The relief air outlet shall be located to avoid reintroduction of exhaust air into the building.

Controls shall be permitted to be installed to reduce the quantity of outdoor air to prevent coil frosting at the lowest stage of compressor unloading.

1305.3.8 Duct and Plenum Insulation and Sealing. All supply and return air ducts and plenums shall be insulated with a minimum of R-5 insulation when located in *unconditioned spaces* and with a minimum of R-8 insulation when located outside the building envelope. When located within a building envelope assembly the duct or plenum shall be separated from the building exterior or unconditioned or exempt spaces by a minimum R-5 insulation. Required R-values are the "labeled" R-values for such ducts.

Exceptions:
1. When located within equipment.
2. When the design temperature difference between the interior and exterior of the duct or plenum does not exceed 15°F.
3. Exhaust air ducts.
4. Outside air supply ducts located outside of the building envelope.

All joints, longitudinal and transverse seams, and connections in duct work, shall be securely fastened and sealed with welds, gaskets, mastics (adhesives), mastic-plus-embedded-fabric systems, or tapes. Tapes and mastics used with rigid fibrous glass ducts shall be listed and labeled in accordance with UL 181A. Tapes and mastics used with flexible air ducts shall be listed and labeled in accordance with UL 181B. Duct tape is not permitted as a sealant on any metal ducts.

Ducts designed to operate at static pressures in excess of three inch. water column shall be leak-tested in accordance with the SMACNA HVAC air duct leakage test manual with the rate of air leakage less than or equal to 6.0 as determined in accordance with Equation 1305.3.8.

Equation 1305.3.8

$$L_{max} = C_L P^{0.65}$$

Where:

L_{max} = the maximum permitted leakage in cfm per 100 ft^2 duct surface

C_L = 6 for square/rectangular sheetmetal or fibrous ducts, 3 for round/oval sheetmetal, fibrous or flexible ducts

P = test pressure which shall be equal to the design duct pressure class rating in inches w.c.

1305.3.9 Piping Insulation. All piping serving as part of a heating or cooling system shall be thermally insulated in accordance with Table 1305.3.9.

Exceptions:
1. Factory-installed piping within HVAC equipment tested and rated in accordance with 780 CMR 1305.3.3.
2. Piping that conveys fluids that have a design operating temperature range between 55°F and 105°F
3. Piping that conveys fluids that have not been heated or cooled through the use of fossil fuels or electrical power.
4. Hot water runout piping not exceeding four feet. in length and one inch in diameter or less between the control valve and HVAC coil.

TABLE 1305.3.9 MINIMUM PIPE INSULATION THICKNESS[a]

Fluid Design Operating Temp. Range (°F)	Insulation Conductivity		Nominal Pipe or Tube Size (in.)				
	Conductivity Btu*in./(h*ft2*°F)	Mean Rating Temp. (°F)	< 1	1 to <1½	1½ to < 4	4 to < 8	>= 8
Heating Systems (Steam, Steam Condensate and Hot Water)							
>350	0.32-0.34		250	2.5	3.0	4.0	4.0
251-350	0.29-0.32		200	1.5	2.5	3.0	3.0
201-250	0.27-0.30		150	1.5	1.5	2.0	2.0
141-200	0.25-0.29		125	1.0	1.0	1.5	1.5
105-140	0.22-0.28		100	0.5	0.5	1.0	1.0
Domestic and Service Hot Water Systems							
105 and Greater	0 22-0.28		100	0.5	0.5	1.0	1.0
Cooling Systems (Chilled Water, Brine, and Refrigerant)							
40-60	0.22-0.28		100	0.5	0.5	1.0	1.0
Below 40	0.22-0.28		100	0.5	1.0	1.5	1.5

a. For insulation outside the stated conductivity range, the minimum thickness (T) shall be determined as follows.

$$T = r[(1 + t/r)^{K}/k$$

Where:

T = minimum insulation thickness (in.);

r = actual outside radius of pipe (in.);

t = insulation thickness listed in this table for applicable fluid temperature and pipe size;

K = conductivity of alternate material at mean rating temperature indicated for the applicable fluid temperature [Btu*in.(h*ft^2*°F)]; and

k = the upper value of the conductivity range listed in Table 1305.3.9 for the applicable fluid temperature.

1305.3.10 Fan System Power. The ratio of the nameplate *fan system power* to the supply fan air flow rate of each HVAC system at design conditions shall not exceed the requirements shown in Table 1305.3.10. *Fan system power* shall be adjusted in accordance with Equation 1305.3.10 for the additional power required by process loads, air treatment or filtering systems with design pressure drops over 1 in. w.c. when filters are clean, heat recovery coils or devices, or direct evaporative humidifiers/coolers.

Equation 1305.3.10

Adjusted fan system power = *Fan system power* - HP Credit

HP Credit (hp) = Sum of [CFM$_n$ x (SP$_n$ - 1.0)/3718] + Sum of [CFM x SP$_{HR}$/3718]

Where:

CFM$_n$ = Supply air volume of the unit with the filtering system, cfm

SP$_n$ = Air pressure drop of the filtering system when filters are clean, in. w.c.

SP$_{HR}$ = Air pressure drop of heat recovery coils or direct evaporative humidifier/cooler, in. w.c.

TABLE 1305.3.10 FAN POWER LIMITATION

Supply Air Volume	Allowable Nameplate Motor Power
	Constant Air VolumeVariable Air Volume
< 20,000 cfm	1.2 hp/1,000 cfm1.7 hp/1,000 cfm
≥ 20,000 cfm	1.1 hp/1,000 cfm1.5 hp/1,000 cfm

1305.3.10.1 Variable Air Volume (VAV) Fan Control. Individual VAV fans with motors 25 hp and larger shall have controls or devices that will result in fan motor demand of no more than 30% of design wattage at 50% of design air volume when static pressure set point equals ⅓ of the total design static pressure, based on manufacturer's certified fan data.

Static pressure sensors used to control variable air volume fans shall be placed in a position such that the controller set point is not able to exceed ⅓ the total design fan static pressure. If this results in the sensor being located downstream of splits in primary duct runs, multiple sensors shall be installed in each major duct.

For systems with direct digital control at the zone level, static pressure set points shall be capable of being reset based on the zone requiring the most pressure.

1305.3.10.2 Fan-Powered VAV Boxes. Fan-Powered VAV boxes shall be capable of being controlled to shut off when the primary system is off except as required to maintain the *zone* at setback temperatures.

1305.3.11 Heat Rejection Equipment.

1305.3.11.1 General. 780 CMR 1305.3.11 applies to heat rejection equipment used in comfort cooling systems covered in Table 1305.3.3.

1305.3.11.2 Fan Speed Control. Each fan associated with a heat rejection device covered in Table 1305.3.3e and powered by a motor of 7.5 hp or larger shall have a fan speed control with the capability to operate that fan at two-thirds of full speed or less, and shall have controls that are capable of automatically changing the fan speed to control the leaving fluid temperature or condensing temperature/pressure of the heat rejection device.

Exceptions:

1. Condenser fans serving multiple refrigerant circuits.
2. Condenser fans serving flooded condensers.
3. Up to ⅓ of the fans on a condenser or tower with multiple fans where the lead fans comply with the speed control requirement

1305.3.12 Exhaust Air Energy Recovery. HVAC fan systems that have both a design supply air capacity of 5000 cfm or greater and have a minimum outside air supply of 70% or greater of the design supply air quantity shall have an energy recovery system that is capable of providing a change in the enthalpy or dry-bulb temperature of the outdoor air supply equal to at least 50% of the difference between the outdoor air and return air at design conditions. A heat recovery system bypass shall be provided to permit air economizer operation as required by 780 CMR 1305.3.7.

Exceptions:

1. Laboratory systems meeting 780 CMR 1305.3.13.2.
2. Systems serving spaces which are not cooled and which are heated to less than 60°F.
3. Systems exhausting toxic, flammable, paint exhaust, corrosive fumes, or dust which makes the installation of heat recovery equipment impractical.
4. Commercial kitchen hoods (grease) classified as Type 1 by *NFPA 96*.
5. Where more than 60% of the outdoor heating energy is provided from site-recovered or site solar energy

1305.3.13 Exhaust Hoods:

1305.3.13.1 Kitchen Hoods. Individual kitchen exhaust hoods larger than 5000 cfm shall be provided with make-up air sized for at least 50% of exhaust air volume that is:

(a) heated to no more than 60°F and

(b) uncooled or cooled without the use of mechanical cooling.

Exceptions:

1. Where hoods are used to exhaust ventilation air which would otherwise exfiltrate or be exhausted by other fan systems.
2. Certified grease extractor hoods that require a face velocity no greater than 60 fpm.

1305.3.13.2 Fume Hoods. Buildings with fume hood systems having a total exhaust rate greater than 15,000 cfm shall include at least one of the following features:

1. Variable air volume hood exhaust and room supply systems capable of reducing exhaust and make-up air volume to 50% or less of design values.
2. Direct make-up (auxiliary) air supply equal to at least 75% of the exhaust rate, heated no warmer than 2°F below room set point, cooled to no cooler than 3°F above room set point, no humidification added, and no simultaneous heating and cooling used for dehumidification control.
3. Heat recovery systems to precondition make-up air from fume hood exhaust in accordance with 1305.3.12 Exhaust Air Heat Recovery, without using any exception.

780 CMR 1306.0 SERVICE WATER HEATING

1306.1 General. 780 CMR 1306.0 covers installation of service hot water piping and controls for service water heating equipment.

1306.2 Temperature Controls. Service water heating equipment shall be provided with controls to allow a set point of 110°F for equipment serving dwelling units and 90°F for equipment serving other occupancies. The outlet temperature of lavatories in public facility restrooms shall be limited to 110°F.

1306.3 Heat Traps. Water heating equipment not supplied with integral heat traps and serving non - circulating systems shall be provided with heat traps on the supply and discharge piping associated with the equipment.

1306.4 Service Hot Water Piping Insulation. Piping on return circulation hot water systems, shall be insulated with 1 inch of insulation having a conductivity not exceeding 0.28 Btu per inch/h * ft^2 *°F. The first eight feet of piping in *nonrecirculating* systems served by equipment without integral heat traps shall be insulated with 1 inch of insulation having a conductivity not exceeding 0.28 Btu per inch/h * ft^2 * °F.

1306.5 Hot Water System Controls. Circulating hot water systems or heat trace shall have automatic time switches that are capable of being set to turn off the system.

1306.6 Swimming Pools:

1306.6.1 Pool Covers. Heated pools shall be equipped with a vapor retardant pool cover on or at the water surface.

Exception. Pools deriving over 60% of the energy for heating from site-recovered energy or solar energy source.

1306.6.2 Pool Heaters. Pool heaters shall meet the efficiency requirements for boilers. Pool heaters fired by natural gas shall not have continuously burning pilot lights.

1306.6.3 On-off Switch. Pool heaters shall be equipped with a readily accessible on-off switch to allow shutting off the heater without adjusting the thermostat setting.

1306.6.4 Time Switches. Time switches shall be installed on swimming pool heaters and pumps.

Exceptions:

1. Where public health standards require 24-hour pump operation.
2. Where pumps are required to operate solar and waste heat recovery pool heating systems.

1306.6.5 Temperature Controls. Heated swimming pools shall be equipped with controls to limit heating water temperatures to not more than 80°F.

Exception. Pools used for therapeutic purposes are exempt when approved by the building official.

1306.7 Space Heating and Water Heating. The use of a gas-fired or oil-fired space heating boiler system to provide the total space heating and water heating for a building is allowed when one of the following conditions is met:

1. The single space heating boiler, or the component of a modular or multiple boiler system that is heating the service water, has a standby loss in Btu/h not exceeding (13.3 x pmd + 400) / n where pmd is the probable maximum demand in gal/h determined in accordance with the procedures described in generally accepted engineering standards and handbooks and n is the fraction of the year when the outdoor daily mean temperature is greater than 64.9°F.

   The standby loss is to be determined for a test period of 24-hour duration while maintaining a boiler water temperature of at least 90°F above ambient, with an ambient temperature between 60°F and 90°F. For a boiler with a modulating burner, this test shall be conducted at the lowest input.
2. It can be demonstrated that the use of a single heat source will provide energy savings compared to separate units.
3. The energy input of the combined boiler and water heater system is less than 150,000 Btu/h.

780 CMR 1307.0 ELECTRIC POWER DISTRIBUTION

1307.1 Scope. Electrical distribution systems shall be designed for the efficient distribution of electrical energy from the service entrance to the points of use.

Exceptions:

1. Buildings in use groups R-3 and R-4 (one-and two-family dwellings).
2. *Emergency power systems.*

1307.2 Electrical Metering. In all multi-family dwellings, each dwelling unit shall be separately metered. Also see 527 CMR 12.00.

Exceptions:

1. Publicly financed housing for the elderly with fuel fired heating systems, with centrally operated air conditioning systems, or without air conditioning systems are exempt from this requirement.
2. Publicly financed housing for the elderly with electric resistance or storage heating systems are exempt from this requirement provided there is informational metering of the individual dwelling units.

1307.3 Voltage Drop:

1307.3.1 Feeders. *Feeder conductors* shall be designed for a maximum *voltage drop* of 2% at the design load calculated in accordance with 2701.0.

1307.3.2 Branch Circuits. *Branch circuit* conductors shall be designed for a maximum *voltage drop* of 3% at the design load calculated in accordance with 2701.0.

1307.4 Transformers. Single-phase and three-phase dry-type and liquid-filled distribution transformers first installed after December 31, 1999 shall be selected based on rating as described in 780 CMR 1307.4.1 and 1307.4.2.

Exceptions:

1. liquid-filled transformers below 10 kVA or dry-type transformers below 15 kVA
2. drive transformers, both AC and DC
3. all rectifier transformers and transformers designed for high harmonics
4. autotransformers
5. non-distribution transformers, such as UPS (Uninterruptible Power Supply) transformers
6. special impedance, regulation, and harmonic transformers
7. sealed and non-ventilated transformers
8. retrofit transformers, machine tool transformers, or welding transformers
9. transformers with tap ranges greater than 15% or frequency other than 60 Hz
10. grounding or testing transformers.

1307.4.1 Liquid Immersed Transformers. Liquid immersed *transformers* shall comply with the minimum efficiencies in Table 1307.4.1 as tested and rated in accordance with the Electric Utility Industry Restructuring Act of November 25, 1997, Section 313. ("NEMA TP1.")

1307.4.2 Low Voltage Dry-type Transformers. Low Voltage Dry-type *transformers* shall comply with the minimum efficiencies in Table 1307.4.2 as tested and rated in accordance with NEMA TP 1.

1307.4.3 Medium Voltage Dry-type Transformers. Medium Voltage Dry-type *transformers* shall have effeciencies not less than the applicable values in Table 1307.4.3 when tested at 50% of the rated output power and at 75° C (Table 1307.4.3 copies Table 4-2 or NEMA TP 1-2002, but adds 3/10 point for each value per M.G.L. c. 25B.)

TABLE 1307.4.1 NEMA CLASS 1 EFFICIENCY LEVELS FOR LIQUID-FILLED DISTRIBUTION TRANSFORMERS

Reference Condition	Temperature	% of Nameplate Load
Load Loss	85°C	50%
No Load Loss	20°C	50%

kVA	Single Phase Efficiency	kVA	Three Phase Efficiency
10	98.3	15	98.0
15	98.5	30	98.3
25	98.7	45	98.5
37.5	98.8	75	98.7
50	98.9	112.5	98.8
75	99.0	150	98.9
100	99.0	225	99.0
167	99.1	300	99.0
250	99.2	500	99.1
333	99.2	750	99.2
500	99.3	1000	99.2
667	99.4	1500	99.3
883	99.4	2000	99.4
		2500	99.4

TABLE 1307.4.2 NEMA CLASS 1 EFFICIENCY LEVELS FOR LOW VOLTAGE DRY-TYPE DISTRIBUTION TRANSFORMERS

Reference Condition Low Voltage		Temperature 75° C	% of Nameplate Load 35%
Single Phase Efficiency		Three Phase Efficiency	
kVa	Low Voltage	kVa	Low Voltage
15	97.7	15	97.0
25	98.0	30	97.5
37.5	98.2	45	97.7
50	98.3	75	98.0
75	98.5	112.5	98.2
100	98.6	150	98.3
167	98.7	225	98.5
250	98.8	300	98.6
333	98.9	500	98.7
500	--	750	98.8
667	--	1000	98.9
833	--	1500	--
		2000	--
		2500	--

TABLE 1307.4.2 NEMA CLASS 1 EFFICIENCY LEVELS FOR MEDIUM VOLTAGE DRY-TYPE DISTRIBUTION TRANSFORMERS

Reference Condition Medium Voltage		Temperature 75°C		% of Nameplate Load 50%	
Single Phase			Three Phase		
Rated power output in kVa	Minimum efficiency %		Rated power output in kVa	Minimum efficiency %	
	≤ 60kV BIL	> 60kV BIL		≤ 60kV BIL	> 60kV BIL
≥15 <25	97.9	97.9	≥15 <30	97.1	97.1
≥25 <37.5	98.2	98.2	≥30 <45	97.6	97.6
≥37.5 <50	98.4	98.4	≥45 <75	97.9	97.9
≥50 <75	98.5	98.5	≥75 <112.5	98.2	98.2
≥75 <100	98.7	98.7	≥112.5 <150	98.4	98.4
≥100 <167	98.8	98.8	≥150 <225	98.5	98.5
≥167 <250	99.1	99	≥225 <300	98.7	98.7
≥250 <333	99.2	99.1	≥300 <500	99.1	98.8
≥333 <500	99.3	99.2	≥500 <750	99.1	99
≥500 <667	99.4	99.3	≥750 <1000	99.2	99.1
≥667 <833	99.5	99.3	≥1000 <1500	99.3	99.2
833	99.5	99.4	≥1500 <2000	99.4	99.3
			≥2000 <2500	99.5	99.3
			2500	99.5	99.4

kVa = kilovolt amperes
kV = kilovolts
BIL = basic impulse insulation level l

780 CMR 1308.0 LIGHTING SYSTEMS

1308.1 General. The lighting criteria in 780 CMR 1308.0 shall apply to lighting for the following:

1. interior spaces of *buildings*;
2. exterior building features, including façades, illuminated roofs, architectural features, entrances, exits, loading docks, and illuminated canopies; and,
3. exterior building grounds lighting provided through the *building's* electrical *service*.

Exceptions:

1. emergency lighting that is automatically off during normal *building* operation and is powered by battery, generator, or other alternate power source; and,
2. lighting within living units of residential buildings;
3. lighting that is specifically designated as required by a health or life safety statute, ordinance, or regulation;
4. decorative gas lighting systems.

1308.2 Lighting Control.

1308.2.1 Automatic Lighting Shutoff. Interior lighting in *buildings* larger than 5000 ft^2 shall be controlled with an *automatic control device* to shut off *building* lighting in all spaces. This *automatic control device* shall function on either:

1. a scheduled basis using a time of day operated control device that turns lighting off at specific programmed times. An independent program schedule shall be provided for areas of no more than 25,000 ft^2 but not more than one floor; or
2. an occupant sensor that shall turn lighting off within 30 minutes of an occupant leaving a space; or
3. an unscheduled basis by occupant intervention.

Exceptions:

1. Lighting intended for 24 hour operation shall not require an Automatic Control Device.
2. Automatic Control Devices are not required in the following spaces: corridors, hallways, stairways and lobbies which are part of a required means of egress; restrooms; mechanical rooms, and; electrical rooms. If automatic control devices are used in the spaces listed, they shall not reduce illumination below the levels prescribed in 780 CMR 1024.0 (Means of Egress Lighting.)

1308.2.2 Space Control. Each space enclosed by ceiling-height partitions shall have at least one *control device* to independently *control* the *general lighting* within the space. Each *control device* shall be activated either manually by an occupant or automatically by sensing an occupant. Each *control device* shall.

1. *control* a maximum of 2,500 ft^2 area for a space 10,000 ft^2 or less, and a maximum of 10,000 ft^2 area for a space greater than 10,000 ft^2,
2. be capable of overriding the shutoff *control* required in 780 CMR 1308.2.1 for no more than two hours, and
3. be readily accessible and located so the occupant can see the controlled lighting.

Exceptions:

1. Remote location shall be permitted for reasons of safety or security when the remote control device has an indicator pilot light as part of or next to the control device and it shall be clearly labeled to identify the controlled lighting.
2. Means of egress lighting which provides the minimum illumination identified in 780 CMR 1308.2.1 Exception 2. shall be controlled in accordance with 780 CMR 1024.0.

1308.2.3 Uniform Reduction. Each perimeter office space enclosed by ceiling-height partitions shall have a manual control to allow the occupant to uniformly reduce the connected lighting load by at least 50%

Exception. Spaces with automatic daylighting controls.

1308.2.4 Additional Control.

1. Display/Accent Lighting - display or accent lighting shall have a separate *control device*.
2. Case Lighting - lighting in cases used for display purposes shall be equipped with a separate *control device*.
3. Hotel and Motel Guest Room Lighting - hotel and motel guest rooms and guest suites shall have a master *control device* at the main room entry that *controls* all *permanently installed luminaires* and switched receptacles.
4. Task Lighting - supplemental task lighting including *permanently installed* undershelf or undercabinet lighting shall have a *control device* integral to the *luminaires* or shall be controlled by a wall- mounted *control device* provided the *control device* complies with 1308.2.2.
5. Nonvisual Lighting - lighting for nonvisual applications, such as plant growth and food-warming, shall be equipped with a separate control *device*.
6. Demonstration Lighting - *lighting equipment* that is for sale or for demonstrations in lighting education shall be equipped with a separate *control device*.

1308.2.5 Exterior Lighting Control. Lighting for all exterior applications not exempted in 780 CMR 1308.1 or 1308.7 shall be controlled by a photosensor or astronomical time switch that is capable of automatically turning off the exterior lighting when sufficient daylight is available or the lighting is not required.

Exception. Lighting for covered vehicle entrances or exits from buildings or parking structures where required for safety, security or eye adaptation.

1308.3 Tandem Wiring. Luminaires designed for use with one or three linear fluorescent lamps greater than 30 W each shall use two lamp tandem-wired ballasts in place of single lamp ballasts when two or more luminaires are in the same space and on the same control device.

Exceptions:

1. recessed luminaires more than ten ft apart measured center to center,
2. surface mounted or pendant luminaires which are not continuous,
3. luminaires using single lamp high-frequency electronic ballasts,
4. luminaires using three lamp high-frequency electronic ballasts or three lamp electromagnetic ballasts,
5. luminaires on emergency circuits,
6. luminaires with no available pair.

1308.4 Exit Signs. Exit sign *luminaires* operating at greater than 20 watts shall have a minimum source efficacy of 35 lm/W.

1308.5 Exterior Building Grounds Lighting. All exterior building grounds luminaires which operate at greater than 100 watts shall contain lamps having a minimum efficacy of 60 lm/W unless the luminaire is controlled by a motion sensor or qualifies for one of the exceptions under 780 CMR 1308.1 or 1308.7.

1308.6 Interior Lighting Power. The *installed interior lighting power* identified in accordance with 780 CMR 1308.6.1 shall not exceed the *interior lighting power allowance* developed in accordance with 780 CMR 1308.6.2.

1308.6.1 Installed Interior Lighting Power. The *installed interior lighting power* shall include the power of all *lighting*. The *installed interior lighting power* includes all power used by the *luminaires*, including *lamps*, *ballasts*, current regulators, and *control devices*.

Exceptions:

1. If two or more independently operating lighting systems in a space are capable of being controlled to prevent simultaneous user operation, the installed interior lighting power shall be based solely on the lighting system with the highest wattage.
2. The following *lighting equipment* and applications shall not be considered when determining the *interior lighting power allowance* developed in accordance with 780 CMR 1308.6.2, nor shall the wattage for such lighting be included in the *installed interior lighting power*. However, any such lighting shall not be exempt unless it is an addition to general lighting and is controlled by an independent *control device*.
   a. Lighting in spaces specifically designed for use by the visually impaired.
   b. See Table 1308.6.2.1, footnote b. and Table 1308.6.2.2, footnotes b. and c. governing lighting for retail displays.
   c. Lighting in interior spaces that have been specifically designated as a registered interior *historic* landmark.
   d. Athletic playing areas with permanently installed lighting for television broadcasting.
   e. Casino gambling areas.
3. The following *lighting equipment* shall not be included in the *installed interior lighting power*. However, any such lighting shall not be exempt unless it is an addition to general lighting and is controlled by an independent *control device*.
   a. Display or accent lighting that is an essential element for the function performed in monuments.
   b. Lighting that is integral to *equipment* or instrumentation and is installed by its *manufacturer*.
   c. Lighting specifically designed for use only during medical or dental procedures and lighting integral to medical *equipment*.
   d. Lighting integral to both open and glass enclosed refrigerator and freezer cases.
   e. Lighting integral to food warming and food preparation *equipment*.
   f. Lighting for plant growth or maintenance.
   g. Lighting that is an integral part of advertising or directional signage.
   h. Exit signs.
   i. Lighting that is for sale or lighting educational demonstration *systems*.
   j. Lighting for theatrical purposes, including, performance, stage, and film and video production.

1308.6.1.1 Luminaire Wattage. Luminaire wattage incorporated into the installed interior lighting power shall be determined in accordance with the following criteria: the wattage of incandescent or tungsten-halogen luminaires with medium screw base sockets and not containing permanently installed ballasts shall be the maximum labeled wattage of the luminaire.

Exceptions:

1. Luminaires for which lower wattage lamps are specified in construction documents, maintenance and operating manuals, and reports specified in 1301.8.4.

2. the wattage of luminaires with permanently installed or remotely installed ballasts shall be the operating input wattage of the specified lamp/ballast combination based on values from manufacturers catalogs or values from independent testing lab reports.

3. the wattage of line voltage lighting track and plug-in busway that allow the addition and/or relocation of luminaires without altering the wiring of the system shall be the lower of.

   a. the specified wattage of the luminaires included in the system with a minimum of 30 W/lin ft.

   b. the specified wattage of the circuit protection device.

4. the wattage of low-voltage lighting track, cable conductor, rail conductor, and other flexible lighting systems that allow for the addition and/or relocation of luminaires without altering the wiring of the system shall be the specified wattage of the transformer supplying the system.

5. the wattage of all other miscellaneous lighting equipment shall be the specified wattage of the equipment.

1308.6.2 Interior Lighting Power Allowance. The *interior lighting power allowance* for a *building* or a separately metered or permitted portion of a *building* shall be determined by either the *building* area method described in 1308.6.2.1 or the Space-by-Space method described in 780 CMR 1308.6.2.2. Trade-offs of *interior lighting power allowance* among portions of the *building* for which a different method of calculation has been used are not permitted.

1308.6.2.1 Building Area Method of Calculating Interior Lighting Power Allowance. The Building Area Method shall be used only in the following cases:

(a) projects involving the entire building, or

(b) projects involving a single, independent, and separate occupancy in a multi-occupancy building.

Use the following steps to determine the interior lighting power allowance by the Building Area Method:

1. Determine the appropriate building type from Table 1308.6.2.1 and the allowed lighting power density (watts/unit area) from the building area method column. For building types not listed, selection of a reasonably equivalent type shall be permitted.
2. Determine the gross lighted floor area (square feet) of the *building*.
3. The *interior lighting power allowance* is the product of the lighted floor area of the *building* times the *lighting power density*.

TABLE 1308.6.2.1 LIGHTING POWER DENSITIES USING THE BUILDING AREA METHOD

Lighting Power Density	
Building Area Type[a]	**(W/ft ^{2})**
Automotive Facility	0.9
Convention Center	1.2
Courthouse	1.2
Dining: Bar Lounge/leisure	1.3
Dining: Cafeteria/fast Food	1.4
Dining: Family	1.6
Dormitory	1.0
Exercise Center	1.0
Gymnasium	1.1
Healthcare-clinic	1.0
Hospital	1.2
Hotel	1.0
Library	1.3
Manufacturing Facility	1.3
Motel	1.0
Motion Picture Theatre	1.2
Multi-family	0.7
Museum	1.1
Office	1.0
Parking Garage	0.3
Penitentiary	1.0
Performing Arts Theater	1.6
Police/fire Station	1.0
Post Office	1.1
Religious Buildings	1.3
Retail[b]	1.5
School/university	1.2
Sports Arena	1.1
Town Hall	1.1
Transportation	1.0
Warehouse	0.8
Workshop	1.4

For SI. 1 foot = 304.8mm, 1 watt per square foot = W/0.0929 m^2

a. In cases where both a general building area type and a more specific building area type are listed, the more specific building area type shall apply.

b. Where lighting equipment is specified to be installed to highlight specific merchandise in addition to lighting equipment specified for general lighting and is switched or dimmed on circuits different from the circuits for general lighting, the smaller of the actual wattage of the lighting equipment installed specifically for merchandise, or 1.6W/ft^2 times the area of the specific display but not to exceed 50% of the floor area, or 3.9 W/ft^{2}times the actual case or shelf area for displaying and selling jewelry, china or silver, shall be added to the interior lighting power determined in accordance with this line item.

1308.6.2.2 Space-by-Space Method of Calculating Interior Lighting Power Allowance. Use the following steps to determine the interior lighting power allowance by the space-by-space method.

1. For each space enclosed by partitions 80% or greater than ceiling height, determine the gross interior floor area by measuring to the center of the partition wall. Include the floor area of balconies or other projections. Retail spaces do not have to comply with the 80% partition height requirements.
2. Determine the *interior lighting power allowance* for each space from Table 1308.6.2.2. Multiply the floor area(s) of the space(s) times the allowed *lighting power density* for the space type that most closely represents the proposed use of the space(s). The product is the *lighting power allowance* for the space(s). For space types not listed, selection of a reasonable equivalent category shall be permitted.
3. The *interior lighting power allowance* is the sum of *lighting power allowances* of all spaces. Trade-offs among spaces are permitted provided that the total *installed interior lighting power* does not exceed the *interior lighting power allowance*.

TABLE 1308.6.2.2 LIGHTING POWER DENSITIES USING THE SPACE-BY-SPACE METHOD

LIGHTING POWER DENSITIES	
Building Type	**LPD (W/ft2)**
Building Specific Space Types[a,b]	
Office - enclosed	1.1
Office - open plan	1.1
Conference/meeting/multipurpose	1.3
Classroom/lecture/training	1.4
for penitentiary	1.3
Lobby	1.3
for hotel	1.1
for performing arts theater	3.3
for motion picture theater	1.1
Audience/seating area	0.9
for gymnasium	0.4
for exercise center	0.3
For convention center	0.7
For penitentiary	0.7
for religious buildings	1.7
for sports arena	0.4
for performing arts theater	2.6
for motion picture theater	1.2
for transportation	0.5
Atrium - first three floors	0.6
Atrium – each additional floor	0.2
Lounge/recreation	1.2
for hospitals	0.8
Dining area	0.9
for penitentiary	1.3
for hotel	1.3
for motel	1.2
for bar lounge/leisure dining	1.4
for family dining	2.1
Food preparation	1.2
Laboratory	1.4
Restrooms	0.9
Dressing/locker/fitting room	0.6
Corridor/transition	0.5
for hospitals	1.0
for manufacturing facilities	0.5
Stairs - active	0.6
Active storage	0.8
for hospitals	0.9
Inactive storage	0.3
for museum	0.8
Electrical/mechanical	1.5
Workshop	1.9
Gymnasium/exercise center	
playing area	1.4
exercise Area	0.9
Court House/police station/penitentiary	
courtroom	1.9
confinement cells	0.9
judges chambers	1.3

LIGHTING POWER DENSITIES	
Building Type	**LPD (W/ft2)**
Building Specific Space Types[a,b]	
Fire stations	
fire station engine room	0.8
sleeping quarters	0.3
Post office sorting area	1.2
Convention center exhibit space	1.3
Library	
card file & cataloguing	1.1
stacks	1.7
reading area	1.2
Hospital	
emergency	2.7
recovery	0.8
nurse station	1.0
exam/treatment	1.5
pharmacy	1.2
patient room	0.7
operating room	2.2
nursery	0.6
medical supply	1.4
physical therapy	1.9
radiology	0.4
laundry/washing	0.6
Automobile - service/repair	0.7
Manufacturing	
low bay (< 25 ft. floor to ceiling height)	1.2
high bay (≥ 25 ft. floor to ceiling height)	1.7
detailed manufacturing	2.1
equipment room	1.2
control room	0.5
Hotel/motel guest rooms	1.1
Dormitory – living quarters	1.1
Museum	
general exhibition	1.0
restoration	1.7
Bank/office – banking activity areas	1.5
Religious buildings	
worship, pulpit, choir	2.4
fellowship hall	0.9
Retail[c]	
sales area	1.7
mall concourse	1.7
Sports arena	
ring sports arena	2.7
court sports arena	2.3
indoor playing field area	1.4
Warehouse	
fine material storage	1.4
medium/bulky material storage	0.9
Parking Garage – garage area	0.2
Transportation	
airport - concourse	0.6
airport/train/bus – baggage area	1.0
terminal – ticket counter	1.5

a. In cases where both a common space type and a building specific type are listed, the building specific space type shall apply.

b. Where installation of lighting equipment for decorative appearances is specified, in addition to lighting equipment for general lighting and is switched or dimmed on circuits different from the circuits for general lighting, the smaller of the actual wattage of the lighting equipment installed specifically for display, or 1.0 W/ft^2 times the area of the space that the decorative lighting equipment is in shall be added to the interior lighting power determined in accordance with this line item.

c. Where installation of lighting equipment to highlight merchandise is specified, in addition to lighting equipment specified for general lighting and is switched or dimmed on circuits different from the circuits for general lighting, the smaller of the actual wattage of the lighting equipment installed specifically for display, or 1.6W/ft^2 times the area of the specific display, or 3.9 W/ft^2 times the actual case or shelf area for displaying and selling fine merchandise such as jewelry, fine apparel and accessories, or china and silver, shall be added to the interior lighting power determined in accordance with this line item.

[ANSI/ASHRAE Standard 90.1-2004 Energy Standard for Buildings Except Low-Rise Residential Buildings, 780 CMR 9.00, Table 9.6.1.

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(Table 9.6.1 has been modified to include footnotes b and c)]

1308.6.2.3 Additional Interior Lighting (Power-by-Space Method). See Tables 1308.6.2.2, footnotes a., b. and/or c.

1308.7 Exterior Building Lighting Power. The exterior lighting power allowance is the sum of lighting power allowances for all of the applicable exterior applications permitted, other than building façades, provided that the total installed exterior lighting power does not exceed the exterior lighting power allowance. Exterior lighting for all other applications (except those included in the Exceptions to 780 CMR 1308.7) shall comply with the requirements of 780 CMR 1308.5.

TABLE 1308.7 LIGHTING POWER LIMITS FOR BUILDING EXTERIORS

APPLICATIONS	MAXIMUM LIGHTING POWER DENSITIES
Tradable Surfaces (Lighting power densities for uncovered parking areas; building grounds; building entrances and exits; canopies and overhangs; and outdoor sales areas may be traded.)	
Uncovered Parking Areas	
Parking lots and drives	0.15 W/ft2
Building Grounds	
Walkways less than 10 feet wide	1.0 watts/linear foot
Walkways 10 feet wide or wider, plaza areas and special feature areas	0.2W/ft2
Stairways	1.0W/ft2
Building Entrances and Exits	
Main entries	30 watts/linear foot of door width
Other doors	20 watts per linear foot of door width
Canopies and Overhangs	
Canopies (free standing and attached and overhangs)	1.25 W/ft2
Outdoor Sales	
Open areas (including vehicle sales lots)	0.5 W/ft2
Street frontage for vehicle sales lots in addition to "open area" allowance	20 watts per linear foot
Nontradable Surfaces (Lighting power density calculations for the following applications can be used only for the specific application and cannot be traded between surfaces or with other exterior lighting. The following allowances are in addition to any allowances otherwise permitted in the "Tradable Surfaces" section of this Table.)	
Building façades	0.2 W/ft2 for each illuminated wall or surface or surface length
Automated Teller Machines and Night Depositories	270 watts per location plus 90 watts per additional ATM per location
Entrances and Gatehouse Inspection Stations at Guarded Facilities	1.25 W/ft2 of uncovered area (covered areas are included in the Canopies and Overhangs section of Tradable Surfaces)
Loading areas for law enforcement, fire ambulance and other emergency service vehicles	0.5 W/ft2 of uncovered area (covered areas are included in the Canopies and Overhangs section of Tradable Surfaces)
Drive-up windows at fast food restaurants	400 watts per drive-through
Parking near 24-hour retail entrances	800 watts per main entry

Exceptions. Lighting used for the following exterior applications is exempt when equipped with an independent *control device*:

1. specialized signal, directional, and marker lighting associated with transportation;
2. Advertising signage or directional signage;
3. Integral to equipment or instrumentation and is installed by its manufacturer;
4. Theatrical purposes, including performance, stage, film production and video production;
5. Athletic playing areas;
6. Temporary lighting;
7. Industrial production, material handling, transportation sites, and associated storage areas;
8. Theme elements in theme/amusement parks; and
9. Used to highlight features of public monuments and registered historic landmark structures or buildings.

780 CMR 1309.0 BUILDING DESIGN BY SYSTEMS ANALYSIS

1309.1 General. 780CMR 1309.0 establishes design criteria in terms of total energy use by a building including all of its systems.

A building designed in accordance with 780CMR 1309.0 will be deemed as complying with 780CMR 13.00 if the annual energy consumption is not greater than if the building were designed with enclosure elements and energy consuming systems in compliance with 780CMR 1304.0 through 1308.0.

1309.2 Analysis Procedure. The analysis of the annual energy usage of the standard and the proposed alternative building and system design shall meet the following criteria:

1. Energy Analysis. The calculation procedure used to simulate the operation of the building and its service systems through a full year operating period shall be of sufficient detail to permit the evaluation of the effect of system design, climatic factors, operational characteristics, and mechanical equipment on annual energy usage. The calculation procedure shall be based upon 8760 hours of operation of the building and its service systems and shall utilize techniques recommended in the ASHRAE Handbook, 1997 Fundamentals Volume.
2. Climatic Data. Coincident hourly data for temperatures, solar radiation, wind and humidity of typical days in the year representing seasonal variation, in accordance with Tables 1303.1 and 1303.2.
3. Energy Sources. Identical energy sources must serve the same purpose in both the standard and the proposed alternative design. If the proposed alternative design results in an increase in consumption of one energy source and a decrease in another energy source, each energy source shall be converted to equivalent Btu units for purposes of comparing the total energy used. Consumption of electricity shall be converted at the rate of 10,000 Btu/kWh for the purpose of this comparison.
4. Nondepletable Energy Sources. Energy collected on site from nondepletable sources shall be omitted from the comparison of total energy used. Energy collected off site from nondepletable sources shall be included in the comparison of total energy used.
5. Building Operation. Building operation shall be simulated for a full calendar year. Operating schedules shall include hourly profiles for daily operation and shall account for variations between weekdays, weekends, holidays, and any seasonal operation. Schedules shall model the time-dependent variations of occupancy, illumination, receptacle loads, thermostat settings, mechanical ventilation, HVAC equipment availability, service hot water usage, and any process loads.

   Exception. Operating schedules shall be permitted to differ between the proposed design and the standard design to allow simulation of the impact of any automatic control provided in the proposed design beyond the minimum requirements in 780 CMR 1304.0 through 1309.0.
6. Simulated Loads. The following systems and loads shall be modeled in determining total building performance. heating systems; cooling systems; fan systems; lighting power; receptacle loads; and process loads that exceed 1.0 watts per square foot of floor area of the room or space in which the process loads are located.

   Exception. Systems required for emergency power only.
7. Service Water Heating Systems. Service water heating systems that are other than combined service hot water/space heating systems shall be permitted to be omitted from the energy analysis provided all requirements of 780 CMR 1306 have been met.
8. Exterior Lighting. Where included in the analysis the exterior lighting systems shall be the same in the standard and proposed designs.

1309.3 Proposed Design. Building systems and loads shall be simulated in the proposed design as follows:

1. HVAC and Service Water Heating Equipment. All HVAC and Service Water Heating Equipment shall be simulated in the proposed design using capacities, rated efficiencies, and part-load performance data for the proposed equipment as provided by the equipment manufacturer.
2. Features Not Documented at Time of Permit. Any feature of the proposed design not included in the construction documents shall be assumed to be

equal to the corresponding feature in the standard design.

3. Mandatory Requirements. The proposed design shall meet the requirements of the following without exception:

  a. 780 CMR 1304.1.2 Moisture Control
  b. 780 CMR 1304.2.7 Slabs on Grade
  c. 780 CMR 1304.2.8 Slabs Below Grade
  d. 780 CMR 1304.3 Air Leakage
  e. 780 CMR 1304.4 Insulation General
  f. 780 CMR 1305.3.4 Temperature and Humidity Controls
  g. 780 CMR 1305.3.8 & .9 Distribution System Construction and Insulation
  h. 780 CMR 1307.0 ELECTRIC POWER DISTRIBUTION
  i. 780 CMR 1308.2 Lighting Control

1309.4 Standard Design. The standard design, conforming to the criteria of 780 CMR 1309, and the proposed design, shall be designed on a common basis as specified herein. The comparison shall be expressed as Btu input per square foot of gross floor area per year.

The heating and cooling system zoning, orientation of each building feature, number of floors, and the gross envelope areas of the standard design shall be the same as those of the proposed design.

Exception. Permanent fixed or movable external shading devices for windows and glazed doors shall be excluded from the standard design.

1309.5 Documentation. Proposed alternative designs, submitted as requests for exception to the standard design criteria, shall be accompanied by an energy analysis comparison report prepared by a professional registered engineer or registered architect. The report shall provide sufficient technical detail on the two buildings and systems designs, and on the data used in and resulting from the comparative analysis, to verify that both the analysis and the designs meet the criteria of 780 CMR 13.00. The documentation shall demonstrate that the analysis used is consistent with ASHRAE calculation procedures and accepted engineering practice.

Exception. Proposed alternative designs for buildings having an area of 5,000 square feet or less and having the indoor temperature controlled from a single point are exempted from the full year energy analysis as described in 780 CMR 1309.2. A comparison of energy consumption between the alternative design and the standard design shall be provided in a report prepared by a registered professional engineer or architect. Such analysis shall follow the bin or degree day methods or other simplified analysis procedures in ASHRAE 1997 Handbook of Fundamentals.

NON-TEXT PAGE

780 CMR 14.00

EXTERIOR WALLS

780 CMR 1401.0 GENERAL

1401.1 Scope. The provisions of 780 CMR 14.00 shall establish the minimum requirements for exterior walls, exterior wall coverings, exterior wall openings, exterior windows and doors, architectural trim, balconies and bay windows.

780 CMR 1402.0 DEFINITIONS

1402.1 General. The following words and terms shall, for the purposes of 780 CMR 14.00 and as used elsewhere in 780 CMR, have the meanings shown in 780 CMR 1402.0.

ADHERED MASONRY VENEER. Veneer secured and supported through the adhesion of an approved bonding material applied to an approved backing.

ANCHORED MASONRY VENEER. Veneer secured with approved mechanical fasteners to an approved backing.

BACKING. The wall or surface to which the veneer is secured.

EXTERIOR WALL. A wall, bearing or nonbearing, that is used as an enclosing wall for a building, other than a fire wall, and that has a slope of 60 degrees (1.05 rad) or greater with the horizontal plane.

EXTERIOR WALL COVERING. A material or assembly of materials applied on the exterior side of exterior walls for the purpose of providing a weather-resisting barrier, insulation or for aesthetics, including but not limited to, veneers, siding, exterior insulation and finish systems, architectural trim and embellishments such as cornices, soffits, facias, gutters and leaders.

EXTERIOR WALL ENVELOPE. A system or assembly of exterior wall components, including exterior wall finish materials, that provides protection of the building structural members, including framing and sheathing materials, and conditioned interior space, from the detrimental effects of the exterior environment.

FIBER CEMENT SIDING. A manufactured, fiber-reinforcing product made with an inorganic hydraulic or calcium silicate binder formed by chemical reaction and reinforced with organic or inorganic nonasbestos fibers, or both. Additives that enhance manufacturing or product performance are permitted. Fiber cement siding products have either smooth or textured faces and are intended for exterior wall and related applications.

METAL COMPOSITE MATERIAL (MCM). A factory-manufactured panel consisting of metal skins bonded to both faces of a plastic core.

METAL COMPOSITE MATERIAL (MCM) SYSTEM. An exterior wall finish system fabricated using MCM in a specific assembly including joints, seams, attachments, substrate, framing and other details as appropriate to a particular design.

VENEER. A facing attached to a wall for the purpose of providing ornamentation, protection or insulation, but not counted as adding strength to the wall.

780 CMR 1403.0 PERFORMANCE REQUIREMENTS

1403.1 General. The provisions of 780 CMR 1403.0 shall apply to exterior walls, wall coverings and components thereof.

1403.2 **Weather Protection**. Exterior walls shall provide the building with a weather-resistant exterior wall envelope. The exterior wall envelope shall include flashing, as described in 780 CMR 1405.3. The exterior wall envelope shall be designed and constructed in such a manner as to prevent the accumulation of water within the wall assembly by providing a water-resistive barrier behind the exterior veneer, as described in 780 CMR 1404.2 and a means for draining water that enters the assembly to the exterior of the veneer, unless it is determined that penetration of water behind the veneer shall not be detrimental to the building performance. ***Protection against condensation in the exterior wall assembly shall be provided in accordance with 780 CMR 13.00.***

Exceptions:

1. A weather-resistant exterior wall envelope shall not be required over concrete or masonry walls designed in accordance with 780 CMR 19.00 and 21.00, respectively.
2. Compliance with the requirements for a means of drainage, and the requirements of 780 CMR 1405.2 and 1405.3, shall not be required for an exterior wall envelope that has been demonstrated through testing to resist wind-driven rain, including joints, penetrations and intersections with dissimilar materials, in accordance with ASTM E 331 under the following conditions:
    2.1. Exterior wall envelope test assemblies shall include at least one opening, one control joint, one wall/eave interface and one wall sill. All tested openings and penetrations shall be representative of the intended end-use configuration.

2.2. Exterior wall envelope test assemblies shall be at least four feet by eight feet (1219 mm by 2438 mm) in size.
2.3. Exterior wall envelope assemblies shall be tested at a minimum differential pressure of 6.24 pounds per square foot (psf) (0.297 kN/m^2).
2.4. Exterior wall envelope assemblies shall be subjected to a minimum test exposure duration of two hours.

The exterior wall envelope design shall be considered to resist wind-driven rain where the results of testing indicate that water did not penetrate control joints in the exterior wall envelope, joints at the perimeter of openings or intersections of terminations with dissimilar materials.

1403.3 **Vapor Retarder**. An approved vapor retarder shall be provided ***(Conformance with the applicable requirements of 780 CMR 13.00 is also required).***

Exceptions:
1. Where other approved means to avoid condensation and leakage of moisture are provided.
2. Plain and reinforced concrete or masonry exterior walls designed and constructed in accordance with Chapter 19 or 21, respectively.

1403.4 Structural. Exterior walls, and the associated openings, shall be designed and constructed to resist safely the superimposed loads required by 780 CMR 16.00.

1403.5 Fire Resistance. Exterior walls shall be fire-resistance rated as required by other sections of 780 CMR with opening protection as required by 780 CMR 7.00.

1403.6 Flood Resistance. For buildings in flood hazard areas as established in 780 CMR 1612.0, exterior walls extending below the design flood elevation shall be resistant to water damage. Wood shall be pressure-preservative treated in accordance with AWPA C1, C2, C3, C4, C9, C15, C18, C22, C23, C24, C28, P1, P2 and P3, or decay-resistant heartwood of redwood, black locust or cedar.

1403.7 Flood Resistance for High-velocity Wave Action Areas. For buildings in flood hazard areas subject to high-velocity wave action as established in 780 CMR 1612.0 electrical, mechanical and plumbing system components shall not be mounted on or penetrate through exterior walls that are designed to break away under flood loads.

780 CMR 1404.0 MATERIALS

1404.1 General. Materials used for the construction of exterior walls shall comply with the provisions of 780 CMR 1404.0. Materials not prescribed in 780 CMR 1404.0 shall be permitted, provided that any such alternative has been approved.

1404.2 Water-resistive Barrier. A minimum of one layer of No. 15 asphalt felt, complying with ASTM D 226 for Type 1 felt, shall be attached to the sheathing, with flashing as described in 780 CMR 1405.3, in such a manner as to provide a continuous water-resistive barrier behind the exterior wall veneer.

1404.3 Wood. Exterior walls of wood construction shall be designed and constructed in accordance with 780 CMR 23.00.

1404.3.1 Basic Hardboard. Basic hardboard shall conform to the requirements of AHA A135.4.

1404.3.2 Hardboard Siding. Hardboard siding shall conform to the requirements of AHA A135.6 and, where used structurally, shall be so identified by the label of an approved agency.

1404.4 Masonry. Exterior walls of masonry construction shall be designed and constructed in accordance with 780 CMR 1404.4 and 780 CMR 21.00. Masonry units, mortar and metal accessories used in anchored and adhered veneer shall meet the physical requirements of 780 CMR 21.00. The backing of anchored and adhered veneer shall be of concrete, masonry, steel framing or wood framing.

1404.5 Metal. Exterior walls of formed steel construction, structural steel or lightweight metal alloys shall be designed in accordance with 780 CMR 22.00 and 20.00, respectively.

1404.5.1 Aluminum Siding. Aluminum siding shall conform to the requirements of AAMA 1402.

1404.5.2 Seismic Requirements. Anchored masonry veneer located in Seismic Design Categories C and D shall conform to the requirements of Section 6.2.2.10 of ACI 530/ASCE 5/TMS 402. Anchored masonry veneer located in Seismic Design Category B shall conform to the requirements for Category C of Section 6.2.2.10 of ACI 530/ASCE 5/TMS 402.

1404.6 Concrete. Exterior walls of concrete construction shall be designed and constructed in accordance with Chapter 19.

1404.7 Glass-unit Masonry. Exterior walls of glass-unit masonry shall be designed and constructed in accordance with Chapter 21.

1404.8 Plastics. Plastic panel, apron or spandrel walls as defined in 780 CMR shall not be limited in thickness, provided that such plastics and their assemblies conform to the requirements of780 CMR 26.00 and are constructed of approved weather-resistant materials of adequate strength to resist the wind loads for cladding specified in 780 CMR 16.00.

1404.9 Vinyl Siding. Vinyl siding shall conform to the requirements of ASTM D 3679.

1404.10 Fiber Cement Siding. Fiber cement siding shall conform to the requirements of ASTM C 1186 and shall be so identified on labeling listing an approved quality control agency.

780 CMR 1405.0 INSTALLATION OF WALL COVERINGS

1405.1 General. Exterior wall coverings shall be designed and constructed in accordance with the applicable provisions of 780 CMR 1405.0.

1405.2 Weather Protection. Exterior walls shall provide weather protection for the building. The materials of the minimum nominal thickness specified in Table 1405.2 shall be acceptable as approved weather coverings.

TABLE 1405.2 MINIMUM THICKNESS OF WEATHER COVERINGS

COVERING TYPE	MINIMUM THICKNESS (inches)
Adhered masonry veneer	0.25
Anchored masonry veneer	2.625
Aluminum siding	0.019
Asbestos-cement boards	0.125
Asbestos shingles	0.156
Cold-rolled copper[d]	0.02 16 nominal
Copper shingles[d]	0.0 162 nominal
Exterior plywood (with sheathing)	0.3 13
Exterior plywood (without sheathing)	See Section 2304.6
Fiberboard siding	0.5
Fiber cement lap siding	0.25[c]
Fiber cement panel siding	0.25[c]
Glass-fiber reinforced concrete panels	0.375
Hardboard siding[c]	0.25
High-yield copper[d]	0.0 162 nominal
Lead-coated copper[d]	0.02 16 nominal
Lead-coated high-yield copper	0.0 162 nominal
Marble slabs	1
Particle board (with sheathing)	See Section 2304.6
Particle board (without sheathing)	See Section 2304.6
Precast stone facing	0.625
Steel (approved corrosion resistant)	0.0 149
Stone (cast artificial)	1.5
Stone (natural)	2
Structural glass	0.344
Stucco or exterior portland cement plaster	
Three-coat work over:	
Metal plaster base	0.875[b]
Unit masonry	0.625[b]
Cast-in-place or precast concrete	0.625[b]
Two-coat work over:	
Unit masonry	0.5[b]
Cast-in-place or precast concrete	0.375[b]
Terra cotta (anchored)	1
Terra cotta (adhered)	0.25
Vinyl siding	0.035
Wood shingles	0.375
Wood siding (without sheathing)[a]	0.5

For SI: 1 inch = 25.4 mm.

a. Wood siding of thicknesses less than 0.5 inch shall be placed over sheathing that conforms to 780 CMR 2304.6.

b. Exclusive of texture.

c. As measured at the bottom of decorative grooves.

d. 16 ounces per square foot for cold-rolled copper and lead-coated copper, 12 ounces per square foot for copper shingles, high-yield copper and lead-coated high-yield copper.

1405.3 Flashing. Flashing shall be installed in such a manner so as to prevent moisture from entering the wall or to redirect it to the exterior. Flashing shall be installed at the perimeters of exterior door and window assemblies, penetrations and terminations of exterior wall assemblies, exterior wall intersections with roofs, chimneys, porches, decks, balconies and similar projections and at built-in gutters and similar locations where moisture could enter the wall. Flashing with projecting flanges shall be installed on both sides and the ends of copings, under sills and continuously above projecting trim.

1405.3.1 Exterior Wall Pockets. In exterior walls of buildings or structures, wall pockets or crevices in which moisture can accumulate shall be avoided or protected with caps or drips, or other approved means shall be provided to prevent water damage.

1405.3.2 Masonry. Flashing and weepholes shall be located in the first course of masonry above finished ground level above the foundation wall or slab, and other points of support, including structural floors, shelf angles and lintels where anchored veneers are designed in accordance with 780 CMR 1405.5.

1405.4 Wood Veneers. Wood veneers on exterior walls of buildings of Type I, II, III and IV construction shall be not less than 1-inch (25 mm) nominal thickness, 0.438-inch (11.1 mm) exterior hardboard siding or 0.375-inch (9.5 mm) exterior-type wood structural panels or particleboard and shall conform to the following:

1. The veneer does not exceed three stories in height, measured from grade, except where fire-retardant-treated wood is used, the height shall not exceed four stories.
2. The veneer is attached to or furred from a noncombustible backing that is fire-resistance rated as required by other provisions of 780 CMR.
3. Where open or spaced wood veneers (without concealed spaces) are used, they shall not project more than 24 inches (610 mm) from the building wall.

1405.5 Anchored Masonry Veneer. Anchored masonry veneer shall comply with the provisions of 780 CMR 1405.5, 1405.6, 1405.7 and 1405.8 and Sections 6.1 and 6.2 of ACI 530/ASCE 5/TMS 402.

1405.5.1 Tolerances. Anchored masonry veneers in accordance with 780 CMR 14.00 are not required to meet the tolerances in Article 3.3 G1 of ACI 530.1/ASCE 6/TMS 602.

1405.5.2 Seismic Requirements. *Anchored masonry veneer located in Seismic Design*

Categories C and D shall conform to the requirements of Section 6.2.2.10 of ACI 530/ASCE 5/TMS 402. Anchored masonry veneer located in Seismic Design Category B shall conform to the requirements for Category C of Section 6.2.2.10 of ACI 530/ASCE 5/TMS 402.

1405.6 Stone Veneer. Stone veneer units not exceeding ten inches (254 mm) in thickness shall be anchored directly to masonry, concrete or to stud construction by one of the following methods:

1. With concrete or masonry backing, anchor ties shall be not less than 0.1055-inch (2.68 mm) corrosion-resistant wire, or approved equal, formed beyond the base of the backing. The legs of the loops shall be not less than six inches (152 mm) in length bent at right angles and laid in the mortar joint, and spaced so that the eyes or loops are 12 inches (305 mm) maximum on center (o.c.) in both directions. There shall be provided not less than a 0.1055-inch (2.68 mm) corrosion-resistant wire tie, or approved equal, threaded through the exposed loops for every two square feet (0.2 m^2) of stone veneer. This tie shall be a loop having legs not less than 15 inches (381 mm) in length bent so that it will lie in the stone veneer mortar joint. The last two inches (51 mm) of each wire leg shall have a right-angle bend. One-inch (25 mm) minimum thickness of cement grout shall be placed between the backing and the stone veneer.
2. With stud backing, a two-inch by two-inch (51 by 51 mm) 0.0625-inch (1.59 mm) corrosion-resistant wire mesh with two layers of waterproofed paper backing in accordance with 780 CMR 1403.3 shall be applied directly to wood studs spaced a maximum of 16 inches (406 mm) o.c. On studs, the mesh shall be attached with two-inch-long (51 mm) corrosion-resistant steel wire furring nails at four inches (102 mm) o.c. providing a minimum 1.125-inch (29 mm) penetration into each stud and with 8d common nails at eight inches (203 mm) o.c. into top and bottom plates or with equivalent wire ties. There shall be not less than a 0.1055-inch (2.68 mm) corrosion-resistant wire, or approved equal, looped through the mesh for every two square feet (0.2 m^2) of stone veneer. This tie shall be a loop having legs not less than 15 inches (381 mm) in length, so bent that it will lie in the stone veneer mortar joint. The last two inches (51 mm) of each wire leg shall have a right-angle bend. One-inch (25 mm) minimum thickness of cement grout shall be placed between the backing and the stone veneer.

1405.7 Slab-type Veneer. Slab-type veneer units not exceeding two inches (51 mm) in thickness shall be anchored directly to masonry, concrete or stud construction. For veneer units of marble, travertine, granite or other stone units of slab form ties of corrosion-resistant dowels in drilled holes located in the middle third of the edge of the units spaced a maximum of 24 inches (610 m) apart around the periphery of each unit with not less than four ties per veneer unit. Units shall not exceed 20 square feet (1.9 m^2) in area. If the dowels are not tight fitting, the holes shall be drilled not more than 0.063 inch (1.6 mm) larger in diameter than the dowel, with the hole countersunk to a diameter and depth equal to twice the diameter of the dowel in order to provide a tight-fitting key of cement mortar at the dowel locations when the mortar in the joint has set. Veneer ties shall be corrosion-resistant metal capable of resisting, in tension or compression, a force equal to two times the weight of the attached veneer. If made of sheet metal, veneer ties shall be not smaller in area than 0.0336 by 1 inch (0.853 by 25 mm) or, if made of wire, not smaller in diameter than 0.1483-inch (3.76 mm) wire.

1405.8 Terra Cotta. Anchored terra cotta or ceramic units not less than 1.625 inches (41 mm) thick shall be anchored directly to masonry, concrete or stud construction. Tied terra cotta or ceramic veneer units shall be not less than 1.625 inches (41 mm) thick with projecting dovetail webs on the back surface spaced approximately 8 inches (203 mm) o.c. The facing shall be tied to the backing wall with corrosion-resistant metal anchors of not less than No. 8 gage wire installed at the top of each piece in horizontal bed joints not less than 12 inches (305 mm) nor more than 18 inches (457 mm) o.c.; these anchors shall be secured to 0.25-inch (6.4 mm) corrosion-resistant pencil rods that pass through the vertical aligned loop anchors in the backing wall. The veneer ties shall have sufficient strength to support the full weight of the veneer in tension. The facing shall be set with not less than a two-inch (51 mm) space from the backing wall and the space shall be filled solidly with portland cement grout and pea gravel. Immediately prior to setting, the backing wall and the facing shall be drenched with clean water and shall be distinctly damp when the grout is poured.

1405.9 Adhered Masonry Veneer. Adhered masonry veneer shall comply with the applicable requirements in 780 CMR 1405.9.1 and Sections 6.1 and 6.3 of ACI 530/ASCE 5/TMS 402.

1405.9.1 Adhesion. Adhesion developed between adhered veneer units and backing shall have a shear strength of at least 50 pounds per square inch (psi) (0.34 MPa) based on gross unit surface area or shall be adhered in compliance with Article 3.3C of ACI 530.1/ASCE 6/TMS 602.

1405.9.1.1 Interior Adhered Masonry Veneers. Interior adhered masonry veneers shall have a maximum weight of 20 psf (0.958 kg/m^2) and shall be installed in accordance with 780 CMR 1405.9. Where the interior veneer is supported by wood construction, the supporting members shall be designed to limit deflection to 1/600 of the span of the supporting members.

1405.10 Metal veneers. Veneers of metal shall be fabricated from approved corrosion-resistant materials or shall be protected front and back with porcelain enamel, or otherwise be treated to render the metal resistant to corrosion. Such veneers shall not be less than 0.0149-inch (0.378 mm) nominal thickness sheet steel mounted on wood or metal furring strips or approved sheathing on the wood construction.

1405.10.1 Attachment. Exterior metal veneer shall be securely attached to the supporting masonry or framing members with corrosion-resistant fastenings, metal ties or by other approved devices or methods. The spacing of the fastenings or ties shall not exceed 24 inches (610 mm) either vertically or horizontally, but where units exceed four square feet (0.4 m^2) in area there shall be not less than four attachments per unit. The metal attachments shall have a cross-sectional area not less than provided by W 1.7 wire. Such attachments and their supports shall be capable of resisting a horizontal force in accordance with the wind loads specified in 780 CMR 1609, but in no case less than 20 psf (0.958 kg/m^2).

1405.10.2 Weather Protection. Metal supports for exterior metal veneer shall be protected by painting, galvanizing or by other equivalent coating or treatment. Wood studs, furring strips or other wood supports for exterior metal veneer shall be approved pressure-treated wood or protected as required in 780 CMR 1403.2. Joints and edges exposed to the weather shall be caulked with approved durable waterproofing material or by other approved means to prevent penetration of moisture.

1405.10.3 Backup. Masonry backup shall not be required for metal veneer except as is necessary to meet the fire-resistance requirements of 780 CMR.

1405.10.4 Grounding. Grounding of metal veneers on buildings shall comply with the requirements of 527 CMR 12.00: the Massachusetts Electrical Code.

1405.11 Glass Veneer. The area of a single section of thin exterior structural glass veneer shall not exceed ten square feet (0.93 m^2) where it is not more than 15 feet (4572 mm) above the level of the sidewalk or grade level directly below, and shall not exceed six square feet (0.56 m^2) where it is more than 15 feet (4572 mm) above that level.

1405.11.1 Length and Height. The length or height of any section of thin exterior structural glass veneer shall not exceed 48 inches (1219 mm).

1405.11.2 Thickness. The thickness of thin exterior structural glass veneer shall be not less than 0.344 inch (8.7 mm).

1405.11.3 Application. Thin exterior structural glass veneer shall be set only after backing is thoroughly dry and after application of an approved bond coat uniformly over the entire surface of the backing so as to effectively seal the surface. Glass shall be set in place with an approved mastic cement in sufficient quantity so that at least 50% of the area of each glass unit is directly bonded to the backing by mastic not less than 0.25 inch (6.4 mm) thick and not more than 0.625 inch (15.9 mm) thick. The bond coat and mastic shall be evaluated for compatibility and shall bond firmly together.

1405.11.4 Installation at Sidewalk Level. Where glass extends to a sidewalk surface, each section shall rest in an approved metal molding, and be set at least 0.25 inch (6.4 mm) above the highest point of the sidewalk. The space between the molding and the sidewalk shall be thoroughly caulked and made water tight.

1405.11.4.1 Installation above Sidewalk Level. Where thin exterior structural glass veneer is installed above the level of the top of a bulkhead facing, or at a level more than 36 inches (914 mm) above the sidewalk level, the mastic cement binding shall be supplemented with approved nonferrous metal shelf angles located in the horizontal joints in every course. Such shelf angles shall be not less than 0.0478-inch (12 mm) thick and not less than two inches (51 mm) long and shall be spaced at approved intervals, with not less than two angles for each glass unit. Shelf angles shall be secured to the wall or backing with expansion bolts, toggle bolts or by other approved methods.

1405.11.5 Joints. Unless otherwise specifically approved by the building official, abutting edges of thin exterior structural glass veneer shall be ground square. Mitered joints shall not be used except where specifically approved for wide angles. Joints shall be uniformly buttered with an approved jointing compound and horizontal joints shall be held to not less than 0.063 inch (1.6 mm) by an approved nonrigid substance or device. Where thin exterior structural glass veneer abuts nonresilient material at sides or top, expansion joints not less than 0.25 inch (6.4 mm) wide shall be provided.

1405.11.6 Mechanical Fastenings. Thin exterior structural glass veneer installed above the level of the heads of show windows and veneer installed more than 12 feet (3658 mm) above sidewalk level shall, in addition to the mastic cement and shelf angles, be held in place by the use of fastenings at each vertical or horizontal edge, or at the four corners of each glass unit. Fastenings shall be secured to the wall or backing with expansion bolts, toggle bolts or by other methods. Fastenings shall be so designed as to hold the glass veneer in a vertical plane independent of the mastic cement. Shelf angles providing both support and fastenings shall be permitted.

1405.11.7 Flashing. Exposed edges of thin exterior structural glass veneer shall be flashed with overlapping corrosion-resistant metal flashing and caulked with a waterproof compound in a manner to effectively prevent the entrance of moisture between the glass veneer and the backing.

1405.12 **Exterior Windows and Doors**. Windows and doors installed in exterior walls shall conform to the testing and performance requirements of 780 CMR 1627.5 ***and otherwise conform to any applicable requirements set forth in 780 CMR 13.00***.

1405.12.1 Installation. Windows and doors shall be installed in accordance with approved manufacturer's instructions. Fastener size and spacing shall be provided in such instructions and shall be calculated based on maximum loads and spacing used in the tests.

1405.13 Vinyl Siding. Vinyl siding conforming to the requirements of 780 CMR 1405.13 and complying with ASTM D 3679 shall be permitted on exterior walls of buildings of Type V construction located in areas where the basic wind speed specified in 780 CMR 16.00 does not exceed 100 miles per hour (161 km/h) and the building height is less than or equal to 40 feet (12 192 mm) in Exposure C. Where construction is located in areas where the basic wind speed exceeds 100 miles per hour (161 km/h), or building heights are in excess of 40 feet (12 192 mm), tests or calculations indicating compliance with 780 CMR 16.00 shall be submitted. Vinyl siding shall be secured to the building so as to provide weather protection for the exterior walls of the building.

1405.13.1 Application. The siding shall be applied over sheathing or materials listed in 780 CMR 2304.6. Siding shall be applied to conform with the weather-resistant barrier requirements in 780 CMR 1403.0. Siding and accessories shall be installed in accordance with approved manufacturer's instructions. Unless otherwise specified in the approved manufacturer's instructions, nails used to fasten the siding and accessories shall have a minimum 0.313-inch (7.9 mm) head diameter and 0.125-inch (3.18 mm) shank diameter. The nails shall be corrosion resistant and shall be long enough to penetrate the studs or nailing strip at least 0.75 inch (19 mm). Where the siding is installed horizontally, the fastener spacing shall not exceed 16 inches (406 mm) horizontally and 12 inches (305 mm) vertically. Where the siding is installed vertically, the fastener spacing shall not exceed 12 inches (305 mm) horizontally and 12 inches (305 mm) vertically.

1405.14 Cement Plaster. Cement plaster applied to exterior walls shall conform to the requirements specified in 780 CMR 25.00.

1405.15 Fiber Cement Siding. Fiber cement siding complying with 780 CMR 1404.10 shall be permitted on exterior walls of Type I, II, III, IV and V construction for wind pressure resistance or wind speed exposures as indicated in the manufacturer's compliance report and approved installation instructions. Where specified, the siding shall be installed over sheathing or materials listed in 780 CMR 2304.6 and shall be installed to conform to the weather-resistant barrier requirements in 780 CMR 1403. Siding and accessories shall be installed in accordance with approved manufacturer's instructions. Unless otherwise specified in the approved manufacturer's instructions, nails used to fasten the siding to wood studs shall be corrosion-resistant round head smooth shank and shall be long enough to penetrate the studs at least one inch (25 mm). For metal framing, all-weather screws shall be used and shall penetrate the metal framing at least three full threads.

1405.16 Fastening. Weather boarding and wall coverings shall be securely fastened with aluminum, copper, zinc, zinc-coated or other approved corrosion-resistant fasteners in accordance with the nailing schedule in Table 2304.9.1 or the approved manufacturer's installation instructions. Shingles and other weather coverings shall be attached with appropriate standard-shingle nails to furring strips securely nailed to studs, or with approved mechanically bonding nails, except where sheathing is of wood not less than one-inch (25 mm) nominal thickness or of wood structural panels as specified in Table 2304.5(3).

1405.17 Fiber Cement Siding.

1405.17.1 Panel Siding. Panels shall be installed with the long dimension parallel to framing. Vertical joints shall occur over framing members and shall be sealed with caulking or covered with battens. Horizontal joints shall be flashed with Z-flashing and blocked with solid wood framing.

1405.17.2 Horizontal Lap Siding. Lap siding shall be lapped a minimum of 1¼ inches (32 mm) and shall have the ends sealed with caulking, covered with an H-section joint cover or located over a strip of flashing. Lap siding courses shall be permitted to be installed with the fastener heads exposed or concealed, according to approved manufacturers' instructions.

780 CMR 1406.0 COMBUSTIBLE MATERIALS ON THE EXTERIOR SIDE OF EXTERIOR WALLS

1406.1 General. 780 CMR 1406.0 shall apply to exterior wall coverings, balconies and similar appendages, and bay and oriel windows constructed of combustible materials.

1406.2 Combustible Exterior Wall Coverings. Combustible exterior wall coverings shall comply with 780 CMR 1406.2.

Exception. Plastics complying with 780 CMR 26.00.

1406.2.1 Ignition Resistance. Combustible exterior wall coverings shall be tested in accordance with NFPA 268.

Exceptions:

1. Wood or wood-based products.
2. Other combustible materials covered with an exterior covering other than vinyl sidings listed in Table 1405.2.
3. Aluminum having a minimum thickness of 0.019 inch (0.48 mm).
4. Exterior wall coverings on exterior walls of Type V construction.

1406.2.1.1 Fire Separation Five Feet or less. Where installed on exterior walls having a fire separation distance of five feet (1524 mm) or less, combustible exterior wall coverings shall not exhibit sustained flaming as defined in NFPA 268.

1406.2.1.2 Fire Separation Greater than Five Feet. For fire separation distances greater than five feet (1524 mm), an assembly shall be permitted that has been exposed to a reduced level of incident radiant heat flux in accordance with the NFPA 268 test method without exhibiting sustained flaming. The minimum fire separation distance required for the assembly shall be determined from Table 1406.2.1.2 based on the maximum tolerable level of incident radiant heat flux that does not cause sustained flaming of the assembly.

1406.2.2 Architectural Trim. In buildings of Type I, II, III and IV construction that do not exceed three stories or 40 feet (12 192 mm) in height above grade plane, exterior wall coverings shall be permitted to be constructed of wood where permitted by 780 CMR 1405.4 or other equivalent combustible material. Combustible exterior wall coverings, other than fire-retardant-treated wood complying with 780 CMR 2303.2 for exterior installation, shall not exceed 10% of an exterior wall surface area where the fire separation distance is five feet (1524 mm) or less. Architectural trim that exceeds 40 feet (12 192 mm) in height above grade plane shall be constructed of approved noncombustible materials and shall be secured to the wall with metal or other approved noncombustible brackets.

TABLE 1406.2.1.2 MINIMUM FIRE SEPARATION FOR COMBUSTIBLE VENEERS FIRE SEPARATION DISTANCE (feet)

FIRE SEPARATION DISTANCE (feet)	TOLERABLE LEVEL INCIDENT RADIANT HEAT ENERGY(kW/m^2)	FIRE SEPARATION DISTANCE (feet)	TOLERABLE LEVEL INCIDENT RADIANT HEAT ENERGY(kW/m^2)
5	12.5	16	5.9
6	11.8	17	5.5
7	11	18	5.2
8	10.3	19	4.9
9	9.6	20	4.6
10	8 9	21	4 4
11	8.3	22	4.1
12	7.7	23	3.9
13	7.2	24	3.7
14	6.7	25	3.5
15	6.3		

For SI: 1 foot = 304.8 mm, 1 Btu/H^2 x°F = .0057 kW/m^2 x K.

1406.2.3 Location. Where combustible exterior wall covering is located along the top of exterior walls, such trim shall be completely backed up by the exterior wall and shall not extend over or above the top of exterior walls.

1406.2.4 Fireblocking. Where the combustible exterior wall covering is furred from the wall and forms a solid surface, the distance between the back of the covering and the wall shall not exceed 1.625 inches (41 mm) and the space thereby created shall be fireblocked in accordance with 780 CMR 717 so that there will be no open space exceeding 100 square feet (9.3 m^2). Where wood furring strips are used, they shall be of approved wood of natural decay resistance or preservative-treated wood.

Exceptions:

1. Fireblocking of cornices is not required in single-family dwellings.
2. Fireblocking shall not be required where installed on noncombustible framing and the face of the exterior wall finish exposed to the concealed space is covered by one of the following materials:
    - 2.1. Aluminum having a minimum thickness of 0.019 inch (0.5 mm);
    - 2.2. Corrosion-resistant steel having a base metal thickness not less than 0.016 inch (0.4 mm) at any point; or
    - 2.3. Other approved noncombustible materials.

1406.3 Balconies and Similar Projections. Balconies and similar projections of combustible construction, other than fire-retardant-treated wood, shall afford the fire-resistance rating required by Table 601 for floor construction or shall be of

Type IV construction as described in 780 CMR 602.4, and the aggregate length shall not exceed 50% of the building perimeter on each floor.

Exceptions:

1. On buildings of Type I and II construction, three stories or less in height, fire-retardant-treated wood shall be permitted for balconies, porches, decks and exterior stairways not used as required exits.
2. Untreated wood is permitted for pickets and rails, or similar guardrail devices that are limited to 42 inches (1067 mm) in height.
3. Balconies and similar appendages on buildings of Type III, IV and V construction shall be permitted to be of Type V construction, and shall not be required to have a fire-resistance rating where sprinkler protection is extended to these areas.
4. Where sprinkler protection is extended to the balcony areas, the aggregate length of the balcony on each floor shall not be limited.

1406.4 Bay windows and oriel windows. Bay and oriel windows shall conform to the type of construction required for the building to which they are attached.

Exception. Fire-retardant-treated wood shall be permitted on buildings three stories or less of Type I, II, III and IV construction.

780 CMR 1407.0 METAL COMPOSITE MATERIALS (MCM)

1407.1 General. The provisions of 780 CMR 1407.0 shall govern the materials, construction and quality of metal composite materials (MCM) for use as exterior wall coverings in addition to other applicable requirements of 780 CMR 14.00 and 780 CMR 16.00.

1407.2 Exterior Wall Finish. MCM used as exterior wall finish or as elements of balconies and similar appendages and bay and oriel windows to provide cladding or weather resistance shall comply with 780 CMR 1407.4 through 1407.13.

1407.3 Architectural Trim and Embellishments. MCM used as architectural trim or embellishments shall comply with 780 CMR 1407.7 through 1407.13.

1407.4 Structural Design. MCM systems shall be designed and constructed to resist wind loads as required by 780 CMR 16.00 for components and cladding.

1407.5 Approval. Results of approved tests or an engineering analysis shall be submitted to the building official to verify compliance with the requirements of 780 CMR 16.00 for wind loads.

1407.6 Weather Resistance. MCM systems shall comply with 780 CMR 1403.0 and shall be designed and constructed to resist wind and rain in accordance with 780 CMR 1407.0 and the manufacturer's installation instructions.

1407.7 Durability. MCM systems shall be constructed of approved materials that maintain the performance characteristics required in 780 CMR 1407.0 for the duration of use.

1407.8 Fire-resistance Rating. Where MCM systems are used on exterior walls required to have a fire-resistance rating in accordance with 780 CMR 704.0, evidence shall be submitted to the building official that the required fire-resistance rating is maintained.

1407.9 Surface-burning Characteristics. Unless otherwise specified, MCM shall have a flame spread index of 75 or less and a smoke-developed index of 450 or less when tested as an assembly in the maximum thickness intended for use in accordance with ASTM E84.

1407.10 Type I, II, III and IV Construction. Where installed on buildings of Type I, II, III and IV construction, MCM systems shall comply with 780 CMR 1407.10.1 through 1407.10.4, or 1407.11.

1407.10.1 Surface-burning Characteristics. MCM shall have a flame spread index of not more than 25 and a smoke-developed index of not more than 450 when tested as an assembly in the maximum thickness intended for use in accordance with ASTM E 84.

1407.10.2 Thermal Barriers. MCM shall be separated from the interior of a building by an approved thermal barrier consisting of 0.5-inch (12.7 mm) gypsum wallboard or equivalent thermal barrier material that will limit the average temperature rise of the unexposed surface to not more than 250°F (121°C) after 15 minutes of fire exposure in accordance with the standard time-temperature curve of ASTM E 119. The thermal barrier shall be installed in such a manner that it will remain in place for not less than 15 minutes based on a test conducted in accordance with UL 1715.

1407.10.3 Thermal Barrier Not Required. The thermal barrier specified for MCM in 780 CMR 1407.10.2 is not required where:

1. The MCM system is specifically approved based on tests conducted in accordance with UL 1040 or UL 1715. Such testing shall be performed with the MCM in the maximum thickness intended for use. The MCM system shall include seams, joints and other typical details used in the installation and shall be tested in the manner intended for use.
2. The MCM is used as elements of balconies and similar appendages, architectural trim or embellishments.

1407.10.4 Full-scale Tests. The MCM exterior wall assembly shall be tested in accordance with, and comply with, the acceptance criteria of NFPA 285. Such testing shall be performed on the MCM system with the MCM in the maximum thickness intended for use.

1407.11 Alternate Conditions. MCM and MCM systems shall not be required to comply with 780 CMR 1407.10.1 through 1407.10.4 provided such systems comply with 780 CMR 1407.11.1 or 1407.11.2.

1407.11.1 Installations up to 40 Feet in Height. MCM shall not be installed more than 40 feet (12 190 mm) in height above the grade plane where installed in accordance with 780 CMR 1407.11.1.1 and 1407.11.1.2.

1407.11.1.1 Fire Separation Distance of Five Feet or less. Where the fire separation distance is five feet (1524 mm) or less, the area of MCM shall not exceed 10% of the exterior wall surface.

1407.11.1.2 Fire Separation Distance Greater than Five Feet. Where the fire separation distance is greater than five feet (1524 mm), there shall be no limit on the area of exterior wall surface coverage using MCM.

1407.11.2 Installations up to 50 Feet in Height. MCM shall not be installed more than 50 feet (15 240 mm) in height above the grade plane where installed in accordance with 780 CMR 1407.11.2.1 and 1407.11.2.2.

1407.11.2.1 Self Ignition Temperature. MCM shall have a self-ignition temperature of 650°F (343°C) or greater when tested in accordance with ASTM D 1929.

1407.11.2.2 Limitations. Sections of MCM shall not exceed 300 square feet (27.9 m^2) in area and shall be separated by a minimum of four feet (1219 mm) vertically.

1407.12 Type V Construction. MCM shall be permitted to be installed on buildings of Type V construction.

NON-TEXT PAGE

780 CMR 15.00

ROOF ASSEMBLIES AND ROOFTOP STRUCTURES

780 CMR 1501.0 GENERAL

1501.1 Scope. The provisions of 780 CMR 15.00 shall govern the design, materials, construction and quality of roof assemblies, and rooftop structures.

780 CMR 1502.0 DEFINITIONS

1502.1 General. The following words and terms shall, for the purposes of 780 CMR 15.00 and as used elsewhere in 780 CMR, have the meanings shown in 780 CMR 1502.0

BUILT-UP ROOF COVERING. Two or more layers of felt cemented together and surfaced with a cap sheet, mineral aggregate, smooth coating or similar surfacing material.

INTERLAYMENT. A layer of felt or nonbituminous saturated felt not less than 18 inches (457 mm) wide, shingled between each course of a wood-shake roof covering.

MECHANICAL EQUIPMENT SCREEN. A partially enclosed rooftop structure used to aesthetically conceal heating, ventilating and air conditioning (HVAC) electrical or mechanical equipment from view.

METAL ROOF PANEL. An interlocking metal sheet having a minimum installed weather exposure of three square feet (.279 m^2) per sheet.

METAL ROOF SHINGLE. An interlocking metal sheet having an installed weather exposure less than three square feet (.279 m^2) per sheet.

MODIFIED BITUMEN ROOF COVERING. One or more layers of polymer-modified asphalt sheets. The sheet materials shall be fully adhered or mechanically attached to the substrate or held in place with an approved ballast layer.

PENTHOUSE. An enclosed, unoccupied structure above the roof of a building, other than a tank, tower, spire, dome cupola or bulkhead, occupying not more than one-third of the roof area.

POSITIVE ROOF DRAINAGE. The drainage condition in which consideration has been made for all loading deflections of the roof deck, and additional slope has been provided to ensure drainage of the roof within 48 hours of precipitation.

REROOFING. The process of recovering or replacing an existing roof covering. See "Roof recover" and "Roof replacement."

ROOF ASSEMBLY. A system designed to provide weather protection and resistance to design loads. The system consists of a roof covering and roof deck or a single component serving as both the roof covering and the roof deck. A roof assembly includes the roof deck, vapor retarder, substrate or thermal barrier, insulation, vapor retarder and roof covering.

ROOF COVERING. The covering applied to the roof deck for weather resistance, fire classification or appearance.

ROOF COVERING SYSTEM. See "Roof assembly."

ROOF DECK. The flat or sloped surface not including its supporting members or vertical supports.

ROOF RECOVER. The process of installing an additional roof covering over a prepared existing roof covering without removing the existing roof covering.

ROOF REPAIR. Reconstruction or renewal of any part of an existing roof for the purposes of its maintenance.

ROOF REPLACEMENT. The process of removing the existing roof covering, repairing any damaged substrate and installing a new roof covering.

ROOF VENTILATION. The natural or mechanical process of supplying conditioned or unconditioned air to, or removing such air from, attics, cathedral ceilings or other enclosed spaces over which a roof assembly is installed.

ROOFTOP STRUCTURE. An enclosed structure on or above the roof of any part of a building.

SCUPPER. An opening in a wall or parapet that allows water to drain from a roof.

SINGLE-PLY MEMBRANE. A roofing membrane that is field applied using one layer of membrane material (either homogeneous or composite) rather than multiple layers.

UNDERLAYMENT. One or more layers of felt, sheathing paper, nonbituminous saturated felt or other approved material over which a steep-slope roof covering is applied.

780 CMR 1503.0 WEATHER PROTECTION

1503.1 General. Roof decks shall be covered with approved roof coverings secured to the building or structure in accordance with the provisions of 780 CMR 15.00. Roof coverings shall be designed, installed and maintained in accordance with 780 CMR and the approved manufacturer's instructions such that the roof covering shall serve to protect the building or structure.

1503.2 Flashing. Flashing shall be installed in such a manner so as to prevent moisture entering the wall and roof through joints in copings, through moisture-permeable materials and at intersections with parapet walls and other penetrations through the roof plane.

1503.2.1 Locations. Flashing shall be installed at wall and roof intersections, at gutters, wherever there is a change in roof slope or direction and around roof openings. Where flashing is of metal, the metal shall be corrosion resistant with a thickness of not less than 0.019 inch (.483 mm) (No. 26 galvanized sheet).

1503.3 Coping. Parapet walls shall be properly coped with noncombustible, weatherproof materials of a width no less than the thickness of the parapet wall.

[P] 1503.4 Roof Drainage. Design and installation of roof drainage systems shall comply with 248 CMR.

1503.4.1 Gutters. Gutters and leaders placed on the outside of buildings, other than Group R-3 as applicable in 780 CMR 120.Z, private garages and buildings of Type V construction, shall be of noncombustible material or a minimum of Schedule 40 plastic pipe.

1503.5 Roof Ventilation. Intake and exhaust vents shall be provided in accordance with 780 CMR 1203.2 and the manufacturer's installation instructions.

780 CMR 1504.0 PERFORMANCE REQUIREMENTS

1504.1 Wind Resistance of Roofs. Roof decks and roof coverings shall be designed for wind loads in accordance with 780 CMR 16.00 and 780 CMR 1504.2, 1504.3 and 1504.4.

1504.1.1 Wind Resistance of Asphalt Shingles. Asphalt shingles shall be designed for wind speeds in accordance with 780 CMR 1507.2.7.

1504.2 Wind Resistance of Clay and Concrete Tile. Clay and concrete tile roof coverings shall be connected to the roof deck in accordance with 780 CMR 16.00.

1504.3 Wind Resistance of Nonballasted Roofs. Roof coverings installed on roofs in accordance with 780 CMR 1507 that are mechanically attached or adhered to the roof deck shall be designed to resist the design wind load pressures for cladding in 780 CMR 16.00.

1504.3.1 Other Roof Systems. Roof systems with built-up, modified bitumen, fully adhered or mechanically attached single-ply through fastened metal panel roof systems, and other types of membrane roof coverings shall also be tested in accordance with FM 4450, FM 4470, UL 580 or UL 1897.

1504.3.2 Metal Panel Roof Systems. Metal panel roof systems through fastened or standing seam shall be tested in accordance with UL 580 or ASTM E 1592.

1504.4 Ballasted Low-slope Roof Systems. Ballasted low-slope (roof slope < 2:12) single-ply roof system coverings installed in accordance with 780 CMR 1507.0 shall be designed in accordance with ANSI/SPRI RP-4.

1504.5 Edge Securement for Low-slope Roofs. Low-slope membrane roof systems metal edge securement, except gutters, installed in accordance with 780 CMR 1507, shall be designed in accordance with ANSI/SPRI ES-1, except the basic wind speed shall be determined from Figure 1609.

1504.6 Physical Properties. Roof coverings installed on low-slope roofs (roof slope < 2:12) in accordance with 780 CMR 1507 shall demonstrate physical integrity over the working life of the roof based upon 2,000 hours of exposure to accelerated weathering tests conducted in accordance with ASTM G 152, ASTM G 155 or ASTM G 154. Those roof coverings that are subject to cyclical flexural response due to wind loads shall not demonstrate any significant loss of tensile strength for unreinforced membranes or breaking strength for reinforced membranes when tested as required.

1504.7 Impact resistance. Roof coverings installed on low-slope roofs (roof slope < 2:12) in accordance with 780 CMR 1507 shall resist impact damage based on the results of tests conducted in accordance with ASTM D 3746, ASTM D 4272, CGSB 37-GP-52M or FM 4470.

780 CMR 1505.0 FIRE CLASSIFICATION

1505.1 General. Roof assemblies shall be divided into the classes defined below. Class A, B and C roof assemblies and roof coverings required to be listed by 780 CMR 1505.0 shall be tested in accordance with ASTM E 108 or UL 790. In addition, fire-retardant-treated wood roof coverings shall be tested in accordance with ASTM D 2898. The minimum roof coverings installed on buildings shall comply with Table 1505.1 based on the type of construction of the building.

TABLE 1505.1[a,b] MINIMUM ROOF COVERING CLASSIFICATION FOR TYPES OF CONSTRUCTION

IA	IB	IIA	IIB	IIIA	IIIB	IV	VA	VB
B	B	B	C[c]	B	C[c]	B	B	C[c]

For SI: 1 foot = 304.8 mm, 1 square foot = 0.0929 m^2.

a. Unless otherwise required in accordance with the *International Urban Wildland Interface Code* or due to the location of the building within a fire district in accordance with Appendix D.

b. Non-classified roof coverings shall be permitted on buildings of Group R-3, as applicable in 780 CMR 120.Z, and Group U occupancies, where there is a minimum fire-separation distance of 6 feet measured from the leading edge of the roof.

c. Buildings that are not more than two stories in height and having not more than 6,000 square feet of projected roof area and where there is a minimum ten-foot fire-separation distance from the leading edge of the roof to a lot line on all sides of the building, except for street fronts or public ways, shall be permitted to have roofs of No. 1 cedar ore wood shakes and No. 1 shingles.

1505.2 Class A Roof Assemblies. Class A roof assemblies are those that are effective against severe fire test exposure. Class A roof assemblies and roof coverings shall be listed and identified as Class A by an approved testing agency. Class A roof assemblies shall be permitted for use in buildings or structures of all types of construction.

Exception. Class A roof assemblies include those with coverings of brick, masonry, slate, clay or concrete roof tile, exposed concrete roof deck, ferrous or copper shingles or sheets.

1505.3 Class B Roof Assemblies. Class B roof assemblies are those that are effective against moderate fire-test exposure. Class B roof assemblies and roof coverings shall be listed and identified as Class B by an approved testing agency.

Exception. Class B roof assemblies include those with coverings of metal sheets and shingles.

1505.4 Class C Roof Assemblies. Class C roof assemblies are those that are effective against light fire-test exposure. Class C roof assemblies and roof coverings shall be listed and identified as Class C by an approved testing agency.

1505.5 Nonclassified Roofing. Nonclassified roofing is approved material that is not listed as a Class A, B or C roof covering.

1505.6 Fire-retardant-treated Wood Shingles and Shakes. Fire-retardant-treated wood shakes and shingles shall be treated by impregnation with chemicals by the full-cell vacuum-pressure process, in accordance with AWPA C1. Each bundle shall be marked to identify the manufactured unit and the manufacturer, and shall also be labeled to identify the classification of the material in accordance with the testing required in 780 CMR 1505.1, the treating company and the quality control agency.

1505.7 Special Purpose Roofs. Special purpose wood shingle or wood shake roofing shall conform with the grading and application requirements of 780 CMR 1507.8 or 1507.9. In addition, an underlayment of 0.625-inch (15.9 mm) Type X water-resistant gypsum backing board or gypsum sheathing shall be placed under minimum nominal 0.5-inch-thick (12.7 mm) wood structural panel solid sheathing or one-inch (25 mm) nominal spaced sheathing.

780 CMR 1506.0 MATERIALS

1506.1 Scope. The requirements set forth in 780 CMR 1506.0 shall apply to the application of roof-covering materials specified in 780 CMR 1506.0. Roof coverings shall be applied in accordance with 780 CMR 15.00 and the manufacturer's installation instructions. Installation of roof coverings shall comply with the applicable provisions of 780 CMR 1507.

1506.2 Compatibility of Materials. Roofs and roof coverings shall be of materials that are compatible with each other and with the building or structure to which the materials are applied.

1506.3 Material Specifications and Physical Characteristics. Roof-covering materials shall conform to the applicable standards listed in 780 CMR 15.00. In the absence of applicable standards or where materials are of questionable suitability, testing by an approved agency shall be required by the building official to determine the character, quality and limitations of application of the materials.

1506.4 Product Identification. Roof-covering materials shall be delivered in packages bearing the manufacturer's identifying marks and approved testing agency labels required in accordance with 780 CMR 1505.0. Bulk shipments of materials shall be accompanied with the same information issued in the form of a certificate or on a bill of lading by the manufacturer.

780 CMR 1507.0 REQUIREMENTS FOR ROOF COVERINGS

1507.1 Scope. Roof coverings shall be applied in accordance with the applicable provisions of 780 CMR 1507.0 and the manufacturer's installation instructions.

1507.2 Asphalt Shingles. The installation of asphalt shingles shall comply with the provisions of 780 CMR 1507.0 and Table 1507.2.

TABLE 1507.2 ASPHALT SHINGLE APPLICATION

COMPONENT	INSTALLATION REQUIREMENT
1. Roof slope	Asphalt shingles shall only be used on roof slopes of two units vertical in 12 units horizontal (2.12) or greater. For roof slopes from two units vertical in 12 units horizontal (2:12) up to four units vertical in 12 units horizontal (4:12), double underlayment application is required in accordance with 780 CMR 1507.2.8.
2. Deck requirement	Asphalt shingles shall be fastened to solidly sheathed roofs.
3. Underlayment	Underlayment shall conform with ASTM D 226, Type 1, or ASTM D 4869, Type 1.
For roof slopes from two units vertical in 12 units horizontal (2:12), up to four units vertical in 12 units horizontal (4:12)	Underlayment shall be two layers applied in the following manner. Apply a minimum 19-inch strip or underlayment felt parallel to and starting at the eaves, fastened sufficiently to hold in place. Starting at the eave, apply 35-inch-wide sheets of underlayment overlapping successive sheets 19 inches and fastened sufficiently to hold in place.
For roof slopes from four units vertical in 12 units horizontal (4:12) or greater	Underlayment shall be one layer applied in the following manner. Underlayment shall be applied shingle fashion, parallel to and starting from the eave and lapped two inches, fastened only as necessary to hold in place.
In areas where the average daily temperature in January is 25 °F or less or where there is a possibility of ice forming along the eaves causing a backup of water	A membrane that consists of at least two layers of underlayment cemented together or of a self-adhering polymer-modified bitumen sheet shall be used in lieu of normal underlayment and extend from the eave's edge to a point at least 24 inches inside the exterior wall line of the building.
4. Application	—
Attachment	Asphalt shingles shall have the minimum number of fasteners required by the manufacturer and 780 CMR 1504 1. Asphalt shingles shall be secured to the roof with not less than four fasteners per strip shingle or two fasteners per individual shingle. Where the roof slope exceeds 20 units vertical in 12 units horizontal (20:12), special methods of fastening are required.
Fasteners	Galvanized, stainless steel, aluminum or copper roofing nails, minimum 12-gage (0.0 15 inch) shank with a minimum ⅜-inch diameter head. Fasteners shall be long enough to penetrate into the sheathing ¾ inch or through the thickness of the sheathing.
Flashings	In accordance with 780 CMR 1507.2.9.

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, °C = [(°F) - 32]/1.8, 1 mile per hour = 1.609 km/h.

1507.2.1 Deck Requirements. Asphalt shingles shall be fastened to solidly sheathed decks.

1507.2.2 Slope. Asphalt shingles shall only be used on roof slopes of two units vertical in 12 units horizontal (17% slope) or greater. For roof slopes from two units vertical in 12 units horizontal (17% slope) up to four units vertical in 12 units horizontal (33% slope), double underlayment application is required in accordance with 780 CMR 1507.2.8.

1507.2.3 Underlayment. Unless otherwise noted, required underlayment shall conform to ASTM D 226, Type I, or ASTM D 4869, Type I.

1507.2.4 Self-adhering Polymer Modified Bitumen Sheet. Self-adhering polymer modified bitumen sheet shall comply with ASTM D 1970.

1507.2.5 Asphalt Shingles. Asphalt shingles shall have self-seal strips or be interlocking, and comply with ASTM D 225 or ASTM D 3462.

1507.2.6 Fasteners. Fasteners for asphalt shingles shall be galvanized, stainless steel, aluminum or copper roofing nails, minimum 12 gage [0.105 inch (2.67 mm)] shank with a minimum 0.375 inch-diameter (9.5 mm) head, of a length to penetrate through the roofing materials and a minimum of 0.75 inch (19.1 mm) into the roof sheathing. Where the roof sheathing is less than 0.75 inch (19.1 mm) thick, the nails shall penetrate through the sheathing. Fasteners shall comply with ASTM F 1667.

1507.2.7 Attachment. Asphalt shingles shall have the minimum number of fasteners required by the manufacturer and 780 CMR 1504.1. Asphalt shingles shall be secured to the roof with not less than four fasteners per strip shingle or two fasteners per individual shingle. Where the roof slope exceeds 20 units vertical in 12 units horizontal (166% slope), special methods of fastening are required. For roofs located where the basic wind speed in accordance with Figure 1609 is 110 mph or greater, special methods of fastening are required. Special fastening methods shall be tested in accordance with ASTM D 3161, modified to use a wind speed of 110 mph.

1507.2.8 Underlayment Application. For roof slopes from two units vertical in 12 units horizontal (17% slope), up to four units vertical in 12 units horizontal (33% slope), underlayment shall be two layers applied in the following manner. Apply a minimum 19-inch-wide (483 mm) strip of underlayment felt parallel with and starting at the eaves, fastened sufficiently to hold in place. Starting at the eave, apply 36-inch-wide (914 mm) sheets of underlayment overlapping successive sheets 19 inches (483 mm) and fastened sufficiently to hold in place. For roof slopes of four units vertical in 12 units horizontal (33% slope) or greater, underlayment shall be one layer applied in the following manner. Underlayment shall be applied shingle fashion, parallel to and starting from the eave and lapped two inches (51 mm), fastened only as necessary to hold in place.

1507.2.8.1 High Wind Attachment. Underlayment applied in areas subject to high winds (greater than 110 mph in accordance with Figure 1609) shall be applied with corrosion- resistant fasteners in accordance with the manufacturer's instructions. Fasteners are to be applied along the overlap at a maximum spacing of 36 inches (914 mm) on center.

1507.2.8.2 Ice Dam Membrane. In areas where the average daily temperature in January is 25°F (-4°C) or less or where there is a possibility of ice forming along the eaves causing a backup of water, a membrane that consists of at least two layers of underlayment cemented together or of a self-adhering polymer modified bitumen sheet shall be used in lieu of normal underlayment and extend from the eave's edge to a point at least 24 inches (610 mm) inside the exterior wall line of the building.

Exception: Detached accessory structures that contain no conditioned floor area.

1507.2.9 Flashings. Flashing for asphalt shingles shall comply with 780 CMR 1507.2.9. Flashing shall be applied in accordance with 780 CMR 1507.2.9 and the asphalt shingle manufacturer's printed instructions.

1507.2.9.1 Base and Cap Flashing. Base and cap flashing shall be installed in accordance with the manufacturer's instructions. Base flashing shall be of either corrosion-resistant metal of minimum nominal 0.019-inch (0.483 mm) thickness or mineral-surfaced roll roofing weighing a minimum of 77 pounds per 100 square feet (3.76 kg/m^2). Cap flashing shall be corrosion-resistant metal of minimum nominal 0.019-inch (0.483 mm) thickness.

1507.2.9.2 Valleys. Valley linings shall be installed in accordance with the manufacturer's instructions before applying shingles. Valley linings of the following types shall be permitted:

1. For open valleys (valley lining exposed) lined with metal, the valley lining shall be at least 16 inches (406 mm) wide and of any of the corrosion-resistant metals in Table 1507.2.9.2.
2. For open valleys, valley lining of two plies of mineral-surfaced roll roofing shall be permitted. The bottom layer shall be 18 inches (457 mm) and the top layer a minimum of 36 inches (914 mm) wide.
3. For closed valleys (valleys covered with shingles), valley lining of one ply of smooth roll roofing complying with ASTM D 224 and at least 36 inches (914 mm) wide or types as described in 780 CMR 1507.2.9.2 Items 1. and 2. shall be permitted. Specialty underlayment shall comply with ASTM D 1970.

TABLE 1507.2.9.2 VALLEY LINING MATERIAL

MATERIAL	MINIMUM THICKNESS	GAGE	WEIGHT
Copper	—	—	16 oz
Aluminum	0.024 in.	—	—
Stainless steel	—	28	—
Galvanized steel	0 0 179 in.	26 (zinc-coated G90)	—
Zinc alloy	0.027 in.	—	—
Lead	—	—	2.5 pounds
Painted terne	—	—	20 pounds

For SI: 1 inch = 25.4 mm, 1 pound = 0.454 kg, 1 ounce = 28.35 g.

1507.2.9.3 Drip Edge. Provide drip edge at eaves and gables of shingle roofs. Overlap to be a minimum of 2 inches (51 mm). Eave drip edges shall extend 0.25 inch (6.4 mm) below sheathing and extend back on the roof a minimum of two inches (51 mm). Drip edge shall be mechanically fastened a maximum of 12 inches (305 mm) o.c. A cricket or saddle shall be installed on the ridge side of any chimney greater than 30 inches (762 mm) wide. Cricket or saddle coverings shall be sheet metal or of the same material as the roof covering.

1507.3 Clay and Concrete Tile. The installation of clay and concrete tile shall comply with the provisions of 780 CMR 1507.3.

1507.3.1 Deck Requirements. Concrete and clay tile shall be installed only over solid sheathing or spaced structural sheathing boards.

1507.3.2 Deck Slope. Clay and concrete roof tile shall be installed on roof slopes of 2½ units vertical in 12 units horizontal (21% slope) or greater. For roof slopes from 2½ units vertical in 12 units horizontal (21% slope) to four units vertical in 12 units horizontal (33% slope), double underlayment application is required in accordance with 780 CMR 1507.3.3.

1507.3.3 Underlayment. Unless otherwise noted, required underlayment shall conform to: ASTM D 226, Type II; ASTM D 2626 or ASTM D 249 Type I mineral-surfaced roll roofing.

1507.3.3.1 Low-slope Roofs. For roof slopes from 2½ units vertical in 12 units horizontal (21% slope), up to four units vertical in 12 units horizontal (33% slope), underlayment shall be a minimum of two layers applied as follows:

1. Starting at the eave, a 19-inch (483 mm) strip of underlayment shall be applied parallel with the eave and fastened sufficiently in place.
2. Starting at the eave, 36-inch-wide (914 mm) strips of underlayment felt shall be applied overlapping successive sheets 19 inches (483 mm) and fastened sufficiently in place.

1507.3.3.2 High-slope Roofs. For roof slopes of four units vertical in 12 units horizontal (33% slope) or greater, underlayment shall be a minimum of one layer of underlayment felt applied shingle fashion, parallel to, and starting from the eaves and lapped two inches (51 mm), fastened only as necessary to hold in place.

1507.3.4 Clay Tile. Clay roof tile shall comply with ASTM C 1167.

1507.3.5 Concrete Tile. Concrete roof tiles shall be in accordance with the physical test requirements as follows:

1. The transverse strength of tiles shall be determined according to Section 6.3 of ASTM C 1167 and in accordance with Table 1507.3.5.
2. The absorption of concrete roof tiles shall be according to Section 8 of ASTM C 140. Roof tiles shall absorb not more than 15 % of the dry weight of the tile during a 24-hour immersion test.
3. Roof tiles shall be tested for freeze/thaw resistance according to Section 8 of ASTM C67. Roof tiles shall show no breakage and not have more than 1% loss in dry weight of any individual concrete roof tile.

TABLE 1507.3.5 TRANSVERSE BREAKING STRENGTH OF CONCRETE ROOF TILE (lbs.)

TILE PROFILE	DRY	
	Average of five tiles	Individual tile
High profile	400	350
Medium profile	300	250
Flat profile	300	250

For SI: 1 pound - 4.45 N

1507.3.6 Fasteners. Tile fasteners shall be corrosion resistant and not less than 11 gage, $^5/_{16}$-inch (8.0 mm) head, and of sufficient length to penetrate the deck a minimum of 0.75 inch (19.1 mm) or through the thickness of the deck, whichever is less. Attaching wire for clay or concrete tile shall not be smaller than 0.083 inch (2.1 mm). Perimeter fastening areas include three tile courses but not less than 36 inches (914 mm) from either side of hips or ridges and edges of eaves and gable rakes.

1507.3.7 Attachment. Clay and concrete roof tiles shall be fastened in accordance with Table 1507.3.7.

TABLE 1507.3.7 CLAY AND CONCRETE TILE ATTACHMENT[a, b, c]

GENERAL — CLAY OR CONCRETE ROOF TILE

Maximum basic wind speed (mph)	Mean roof height (feet)	Roof slope up to < 3:12	Roof slope 3:12 and over
85	0-60	One fastener per tile. Flat tile without vertical laps, two fasteners per tile.	Two fasteners per tile. Only one fastener on slopes of 7:12 and less for tiles with installed weight exceeding 7.5 lbs./sq. ft. having a width no greater than 16 inches
100	0-40		
100	> 40-60	The head of all tiles shall be nailed. The nose of all eave tiles shall be fastened with approved clips. All rake tiles shall be nailed with two nails. The nose of all ridge, hip and rake tiles shall be set in a bead of roofer's mastic.	
110	0-60	The fastening system shall resist the wind forces in 780 CMR 16.00	
120	0-60	The fastening system shall resist the wind forces in 780 CMR 16.00	
130	0-60	The fastening system shall resist the wind forces in 780 CMR 16.00	
All	> 60	The fastening system shall resist the wind forces in 780 CMR 16.00	

INTERLOCKING CLAY OR CONCRETE ROOF TILE WITH PROJECTING ANCHOR LUGS[d, e]
(Installations on spaced/solid sheathing with battens or spaced sheathing)

Maximum basic wind speed (mph)	Mean roof height (feet)	Roof slope up to < 5:12	Roof slope 5:12 < 12:12	Roof slope 12:12 and over
85	0-60	Fasteners are not required. Tiles with installed weight less than 9 lbs./sq ft. require a minimum of one fastener per tile	One fastener per tile every other row. All perimeter tiles require one fastener. Tiles with installed weight less than 9 lbs./sq. ft. require a minimum of one fastener per tile.	One fastener required for every tile. Tiles with installed weight less than 9 lbs /sq. ft. require a minimum of one fastener per tile.
100	0-40			
100	> 40-60	The head of all tiles shall be nailed. The nose of all eave tiles shall be fastened with approved clips. All rake tiles shall be nailed with two nails The nose of all ridge, hip and rake tiles shall be set in a bead of roofers's mastic.		
110	0-60	The fastening system shall resist the wind forces in 780 CMR 16.00		
120	0-60	The fastening system shall resist the wind forces in 780 CMR 16.00		
130	0-60	The fastening system shall resist the wind forces in 780 CMR 16.00		
All	> 60	The fastening system shall resist the wind forces in 780 CMR 16.00		

INTERLOCKING CLAY OR CONCRETE ROOF TILE WITH PROJECTING ANCHOR LUGS
(Installations on solid sheathing without battens)

Maximum basic wind speed (mph)	Mean roof height (feet)	All roof slopes
85	0-60	One fastener per tile.
100	0-40	One fastener per tile.
100	> 40-60	The head of all tiles shall be nailed. The nose of all eave tiles shall be fastened with approved clips. All rake tiles shall be nailed with two nails The nose of all ridge, hip and rake tiles shall be set in a bead of roofers's mastic.
110	0-60	The fastening system shall resist the wind forces in 780 CMR 16 00
120	0-60	The fastening system shall resist the wind forces in 780 CMR 16.00
130	0-60	The fastening system shall resist the wind forces in 780 CMR 16 00
All	> 60	The fastening system shall resist the wind forces in 780 CMR 16.00

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mile per hour = 1.609 km/h, 1 pound per square foot = 0.0478 kn/m^2.

a. Minimum fastener size. Corrosion-resistant nails not less than No. 11 gage with $^5/_{16}$-inch head. Fasteners shall be long enough to penetrate into the sheathing 0.75 inch or through the thickness of the sheathing, whichever is less. Attaching wire for clay and concrete tile shall not be smaller than 0.083 inch.

b. Snow areas. A minimum of two fasteners per tile are required or battens and one fastener.

c. Roof slopes greater than 24:12. The nose of all tiles shall be securely fastened.

d. Horizontal battens. Battens shall be not less than 1inch by two inch nominal. Provisions shall be made for drainage by a minimum of ⅛-inch riser at each nail or by four-foot-long battens with at least a 0.5-inch separation between battens. Horizontal battens are required for slopes over 7:12.

e. Perimeter fastening areas include three tile courses but not less than 36 inches from either side of hips or ridges and edges of eaves and gable rakes.

1507.3.8 Application. Tile shall be applied according to the manufacturer's installation instructions, based on the following:

1. Climatic conditions.
2. Roof slope.
3. Underlayment system.
4. Type of tile being installed.

1507.3.9 Flashing. At the juncture of the roof vertical surfaces, flashing and counterflashing shall be provided in accordance with the manufacturer's installation instructions, and where of metal, shall not be less than 0.019-inch (0.48 mm) (No. 26 galvanized sheet gage) corrosion-resistant. The valley flashing shall extend at least 11 inches (279 mm) from the centerline each way and have a splash diverter rib not less than one inch (25 mm) high at the flow line formed as part of the flashing. Sections of flashing shall have an end lap of not less than 4 inches (102 mm). For roof slopes of three units vertical in 12 units horizontal (25% slope) and over, the valley flashing shall have a 36-inch-wide (914 mm) underlayment of one layer of Type I underlayment running the full length of the valley, in addition to other required underlayment. In areas where the average daily temperature in January is 25°F (-4°C) or less or where there is a possibility of ice forming along the eaves causing a backup of water, the metal valley flashing underlayment shall be solid cemented to the roofing underlayment for slopes under seven units vertical in 12 units horizontal (58% slope) or of self-adhering polymer modified bitumen sheet.

1507.4 Metal Roof Panels. The installation of metal roof panels shall comply with the provisions of 780 CMR 1507.0.

1507.4.1 Deck Requirements. Metal roof panel roof coverings shall be applied to a solid or closely fitted deck, except where the roof covering is specifically designed to be applied to spaced supports.

1507.4.2 Deck Slope. The minimum slope for lapped, nonsoldered seam metal roofs without applied lap sealant shall be three units vertical in 12 units horizontal (25% slope). The minimum slope for lapped, nonsoldered seam metal roofs with applied lap sealant shall be one-half vertical unit in 12 units horizontal (4% slope). The minimum slope for standing seam of roof systems shall be ¼ unit vertical in 12 units horizontal (2% slope).

1507.4.3 Material Standards. Metal-sheet roof covering systems that incorporate supporting structural members shall be designed in accordance with 780 CMR 22.00. Metal-sheet roof coverings installed over structural decking shall comply with Table 1507.4.3.

1507.4.4 Attachment. Metal roofing fastened directly to steel framing shall be attached by approved manufacturers' fasteners. In the absence of manufacturer recommendations, all of the following fasteners shall be used:

1. Galvanized fasteners shall be used for galvanized roofs.
2. 300 series stainless-steel fasteners shall be used for copper roofs.
3. Stainless-steel fasteners are acceptable for all types of metal roofs.

TABLE 1507.4.3 METAL ROOF COVERINGS

ROOF COVERING TYPE	STANDARD APPLICATION RATE/THICKNESS
Aluminum	ASTM B 209, 0.024 inch minimum thickness for roll-formed panels and 0.019 inch minimum thickness for press-formed shingles.
Aluminum-zinc alloy coated steel	ASTM A 792 AZ 50
Copper	16 oz/sq ft. for metal-sheet roof-covering systems; 12 oz./sq. ft. for preformed metal shingle systems.
Galvanized steel	ASTM A 653 G-90 zinc-coated, 0.013-inch-thick minimum
Lead-coated copper	ASTM B 101
Hard lead	2 lbs/sq. ft.
Soft lead	3 lbs/sq. ft.
Prepainted steel	ASTM A 755
Terne (tin) and terne-coated stainless	Terne coating of 40 lbs. per double base box, field painted where applicable in accordance with manufacturer's installation instructions.

For SI: 1 ounce per square foot = 0.0026 kg/m^2,
1 pound per square foot = 4.882 kg/m^2,
1 inch = 25.4 mm, 1 pound = 0.454 kg.

1507.5 Metal Roof Shingles. The installation of metal roof shingles shall comply with the provisions of 780 CMR 1507.5.

1507.5.1 Deck Requirements. Metal roof shingles shall be applied to a solid or closely fitted deck, except where the roof covering is specifically designed to be applied to spaced sheathing.

1507.5.2 Deck Slope. Metal roof shingles shall not be installed on roof slopes below three units vertical in 12 units horizontal (25% slope).

1507.5.3 Underlayment. Underlayment shall conform to ASTM D 226, Type I. In areas where the average daily temperature in January is 25°F (-4°C) or less or where there is a possibility of ice forming along the eaves causing a backup of water, an ice barrier that consists of at least two layers of underlayment cemented together or of a self-adhering polymer-modified bitumen sheet, shall be used in lieu of normal underlayment and extend from the eave's edge to a point at least 24 inches (610 mm) inside the exterior wall line of the building.

Exception. Detached accessory structures that contain no conditioned floor area.

1507.5.4 Material Standards. Metal roof shingle roof coverings shall comply with Table 1507.4.3.

1507.5.5 Attachment. Metal roof shingles shall be secured to the roof in accordance with the approved manufacturer's installation instructions.

1507.5.6 Flashing. Roof valley flashing shall be of corrosion-resistant metal of the same material as the roof covering or shall comply with the standards in Table 1507.4.3. The valley flashing shall extend at least eight inches (203 mm) from the centerline each way and shall have a splash diverter rib not less than 0.75 inch (19.1 mm) high at the flow line formed as part of the flashing. Sections of flashing shall have an end lap of not less than four inches (102 mm). In areas where the average daily temperature in January is 25°F (-4°C) or less or where there is a possibility of ice forming along the eaves causing a backup of water, the metal valley flashing shall have a 36-inch-wide (914 mm) underlayment directly under it consisting of one layer of underlayment running the full length of the valley, in addition to underlayment required for metal roof shingles. The metal valley flashing underlayment shall be solid cemented to the roofing underlayment for roof slopes under seven units vertical in 12 units horizontal (58% slope) or of self-adhering polymer-modified bitumen sheet.

1507.6 Mineral-surfaced Roll Roofing. The installation of mineral-surfaced roll roofing shall comply with 780 CMR 1507.6.

1507.6.1 Deck Requirements. Mineral-surfaced roll roofing shall be fastened to solidly sheathed roofs.

1507.6.2 Deck Slope. Mineral-surfaced roll roofing shall not be applied on roof slopes below one unit vertical in 12 units horizontal (8% slope).

1507.6.3 Underlayment. Underlayment shall conform to ASTM D 226, Type I. In areas where the average daily temperature in January is 25°F (-4°C) or less or where there is a possibility of ice forming along the eaves causing a backup of water, an ice barrier that consists of at least two layers of underlayment cemented together or of a self-adhering polymer-modified bitumen sheet, shall extend from the eave's edge to a point at least 24 inches (610 mm) inside the exterior wall line of the building.

Exception: Detached accessory structures that contain no conditioned floor area.

1507.6.4 Material Standards. Mineral-surfaced roll roofing shall conform to ASTM D 224, ASTM D 249, ASTM D 371 or ASTM D 3909.

1507.7 Slate Shingles. The installation of slate shingles shall comply with the provisions of 780 CMR 1507.7.

1507.7.1 Deck Requirements. Slate shingles shall be fastened to solidly sheathed roofs.

1507.7.2 Deck Slope. Slate shingles shall only be used on slopes of four units vertical in 12 units horizontal (4:12) or greater.

1507.7.3 Underlayment. Underlayment shall comply with ASTM D 226, Type II. In areas where the average daily temperature in January is 25°F (-4°C) or less or where there is a possibility of ice forming along the eaves causing a backup of water, an ice barrier that consists of at least two layers of underlayment cemented together or of a self-adhering polymer-modified bitumen sheet, shall extend from the eave's edge to a point at least 24 inches (610 mm) inside the exterior wall line of the building.

Exception. Detached accessory structures that contain no conditioned floor area.

1507.7.4 Material Standards. Slate shingles shall comply with ASTM C 406.

1507.7.5 Application. Minimum headlap for slate shingles shall be in accordance with Table 1507.7.5. Slate shingles shall be secured to the roof with two fasteners per slate.

TABLE 1507.7.5 SLATE SHINGLE HEADLAP

SLOPE	HEADLAP (inches)
4:12 < slope < 8:12	4
8:12 < slope < 20.12	3
slope ≥ 20:12	2

For SI: 1 onch - 25.4 mm.

1507.7.6 Flashing. Flashing and counterflashing shall be made with sheet metal. Valley flashing shall be a minimum of 15 inches (381 mm) wide. Valley and flashing metal shall be a minimum uncoated thickness of 0.0179-inch (0.455 mm) zinc-coated G90. Chimneys, stucco or brick walls shall have a minimum of two plies of felt for a cap flashing consisting of a four-inch-wide (102 mm) strip of felt set in plastic cement and extending 1 inch (25 mm) above the first felt and a top coating of plastic cement. The felt shall extend over the base flashing two inches (51 mm).

1507.8 Wood Shingles. The installation of wood shingles shall comply with the provisions of 780 CMR 1507.8 and Table 1507.8.

TABLE 1507.8 WOOD SHINGLE AND SHAKE INSTALLATION

ROOF ITEM	WOOD SHINGLES	WOOD SHAKES
1. Roof slope	Wood shingles shall be installed on slopes of three units vertical in 12 units horizontal (3:12) or greater.	Wood shakes shall be installed on slopes of four units vertical in 12 units horizontal (4:12) or greater.
2. Deck requirement	—	—
Temperate climate	Shingles shall be applied to roofs with solid or spaced sheathing. Where spaced sheathing is used, sheathing boards shall not be less than one inch by four inch nominal dimensions and shall be spaced on center equal to the weather exposure to coincide with the placement of fasteners.	Shakes shall be applied to roofs with solid or spaced sheathing.Where spaced sheathing is used, sheathing boards shall not be less than inch by four inch nominal dimensions and shall be spaced on center equal to the weather exposure to coincide with the placement of fasteners. When inch by four inch spaced sheathing is installed at ten inches, boards must be installed between the sheathing boards.
In areas where the average daily temperature in January is 25°F or less or where there is a possibility of ice forming along the eaves causing a backup of water.	Solid sheathing required.	Solid sheathing is required.
3. Interlayment	No requirements.	Interlayment shall comply with ASTM D 226, Type 1.
4. Underlayment	—	—
Temperate climate	Underlayment shall comply with ASTM D 226, Type 1.	Underlayment shall comply with ASTM D 226, Type 1.
In areas where the average daily temperature in January is 25°F or less or where there is a possibility of ice forming along the eaves causing a backup of water.	An ice shield that consists of at least two layers of underlayment cemented together or of a self-adhering polymer-modified bitumen sheet shall extend from the eave's edge to a point at least 24 inches inside the exterior wall line of the building.	An ice shield that consists of at least two layers of underlayment cemented together or of a self-adhering polymer-modified bitumen sheet shall extend from the eave's edge to a point at least 24 inches inside the exterior wall line of the building.
5. Application	—	—
Attachment	Fasteners for wood shingles shall be corrosion resistant with a minimum penetration of 0.75 inch into the sheathing. For sheathing less than 0.5 inch thick, the fasteners shall extend through the sheathing.	Fasteners for wood shakes shall be corrosion resistant with a minimum penetration of 0.75 inch into the sheathing. For sheathing less than 0.5 inch thick, the fasteners shall extend through the sheathing.
No. of fasteners	Two per shingle.	Two per shake.
Exposure	Weather exposures shall not exceed those set forth in Table 1507.8.6	Weather exposures shall not exceed those set forth in Table 1507.9.7
Method	Shingles shall be laid with a side lap of not less than 1.5 inches between joints in courses, and no two joints in any three adjacent courses shall be in direct alignment. Spacing between shingles shall be 0.25 to 0.375 inch.	Shakes shall be laid with a side lap of not less than 1.5 inches between joints in adjacent courses. Spacing between shakes shall not be less than 0.375 inch or more than 0.625 inch for shakes and tapersawn shakes of naturally durable wood and shall be 0 25 to 0.375 inch for preservative taper sawn shakes.
Flashing	In accordance with 780 CMR 1507.8.7.	In accordance with 780 CMR 1507.9.8.

For SI: 1 inch = 25.4 mm, °C - [(°F)-32]/8.

1507.8.1 Deck Requirements. Wood shingles shall be installed on solid or spaced sheathing. Where spaced sheathing is used, sheathing boards shall not be less than one-inch by four-inch (25 mm by 102 mm) nominal dimensions and shall be spaced on centers equal to the weather exposure to coincide with the placement of fasteners.

1507.8.1.1 Solid Sheathing Required. Solid sheathing is required in areas where the average daily temperature in January is 25°F (-4°C) or less or where there is a possibility of ice forming along the eaves causing a backup of water.

1507.8.2 Deck Slope. Wood shingles shall be installed on slopes of three units vertical in 12 units horizontal (25% slope) or greater.

1507.8.3 Underlayment. Underlayment shall comply with ASTM D 226, Type I. In areas where the average daily temperature in January is 25°F (-4°C) or less or where there is a possibility of ice forming along the eaves causing a backup of water, an ice barrier that consists of at least two layers of underlayment cemented together or of a self-adhering polymer-modified bitumen sheet shall extend from the eave's edge to a point at least 24 inches (610 mm) inside the exterior wall line of the building.

Exception. Detached accessory structures that contain no conditioned floor area.

1507.8.4 Material Standards. Wood shingles shall be of naturally durable wood and comply with the requirements of Table 1507.8.4.

TABLE 1507.8.4 WOOD SHINGLE MATERIAL REQUIREMENTS

MATERIAL	APPLICABLE MINIMUM GRADES	GRADING RULES
Wood shingles of naturally durable wood	1, 2 or 3	CSSB

CSSB - Cedar Shake and Shingle Bureau

1507.8.5 Attachment. Fasteners for wood shingles shall be corrosion resistant with a minimum penetration of 0.75 inch (19.1 mm) into the sheathing. For sheathing less than 0.5 inch (12.7 mm) in thickness, the fasteners shall extend through the sheathing. Each shingle shall be attached with a minimum of two fasteners.

1507.8.6 Application. Wood shingles shall be laid with a side lap not less than 1.5 inches (38 mm) between joints in adjacent courses, and not be in direct alignment in alternate courses. Spacing between shingles shall be 0.25 to 0.375 inches (6.4 to 9.5 mm). Weather exposure for wood shingles shall not exceed that set in Table 1507.8.6.

TABLE 1507.8.6 WOOD SHINGLE WEATHER EXPOSURE AND ROOF SLOPE

ROOFING MATERIAL	LENGTH (inches)	GRADE	EXPOSURE (inches)	
			3:12 pitch to < 4:12	4:12 pitch or steeper
Shingles of naturally durable wood	16	No. 1	3.75	5
		No. 2	3.5	4
		No 3	3	3.5
	18	No. 1	4.25	5.5
		No. 2	4	4.5
		No. 3	3.5	4
	24	No. 1	5.75	7.5
		No. 2	5.5	6.5
		No. 3	5	5.5

For SI: 1 inch - 25.4 mm.

1507.8.7 Flashing. At the juncture of the roof and vertical surfaces, flashing and counterflashing shall be provided in accordance with the manufacturer's installation instructions, and where of metal, shall not be less than 0.019-inch (0.48 mm) (No. 26 galvanized sheet gage) corrosion-resistant metal. The valley flashing shall extend at least 11 inches (279 mm) from the centerline each way and have a splash diverter rib not less than one inch (25 mm) high at the flow line formed as part of the flashing. Sections of flashing shall have an end lap of not less than four inches (102 mm). For roof slopes of three units vertical in 12 units horizontal (25% slope) and over, the valley flashing shall have a 36-inch-wide (914 mm) underlayment of one layer of Type I underlayment running the full length of the valley, in addition to other required underlayment. In areas where the average daily temperature in January is 25°F (-4°C) or less or where there is a possibility of ice forming along the eaves causing a backup of water, the metal valley flashing underlayment shall be solid cemented to the roofing underlayment for slopes under seven units vertical in 12 units horizontal (58% slope).

1507.9 Wood Shakes. The installation of wood shakes shall comply with the provisions of 780 CMR 1507.9 and Table 1507.8.

1507.9.1 Deck Requirements. Wood shakes shall only be used on solid or spaced sheathing. Where spaced sheathing is used, sheathing boards shall not be less than one-inch by four-inch (25 mm by 102 mm) nominal dimensions and shall be spaced on centers equal to the weather exposure to coincide with the placement of fasteners. Where one-inch by four-inch (25 mm by 102 mm) spaced sheathing is installed at ten inches (254 mm) o.c., additional one-inch by four-inch (25 mm by 102 mm) boards shall be installed between the sheathing boards.

1507.9.1.1 Solid Sheathing Required. Solid sheathing is required in areas where the average daily temperature in January is 25°F (-4°C) or less or where there is a possibility of ice forming along the eaves causing a backup of water.

1507.9.2 Deck Slope. Wood shakes shall only be used on slopes of four units vertical in 12 units horizontal (33% slope) or greater.

1507.9.3 Underlayment. Underlayment shall comply with ASTM D 226, Type I. In areas where the average daily temperature in January is 25°F (-4°C) or less or where there is a possibility of ice forming along the eaves causing a backup of water, an ice barrier that consists of at least two layers of underlayment cemented together or a self-adhering polymer-modified bitumen sheet shall extend from the edge of the eave to a point at least 24 inches (610 mm) inside the exterior wall line of the building.

Exception. Detached accessory structures that contain no conditioned floor area.

1507.9.4 Interlayment. Interlayment shall comply with ASTM D 226, Type I.

1507.9.5 Material Standards. Wood shakes shall comply with the requirements of Table 1507.9.5.

TABLE 1507.9.5 WOOD SHAKE MATERIAL REQUIREMENTS

MATERIAL	MINIMUM GRADES	APPLICABLE GRADING RULES
Wood shakes of naturally durable wood	1	CSSB
Taper sawn shakes of naturally durable wood	1 or 2	CSSB
Preservative-treated shakes and shingles of naturally durable wood	1	CSSB
Fire-retardant-treated shakes and shingles of naturally durable wood	1	CSSB
Preservative-treated taper sawn shakes of Southern yellow pine treated in accordance with AWPA Standard C2	1 or 2	TFS

CSSB = Cedar Shake and Shingle Bureau.

TFS = Forest Products Laboratory of the Texas Forest Services.

1507.9.6 Attachment. Fasteners for wood shakes shall be corrosion resistant with a minimum penetration of 0.75 inch (19.1 mm) into the sheathing. For sheathing less than 0.5 inch (12.7 mm) in thickness, the fasteners shall extend through the sheathing. Each shake shall be attached with a minimum of two fasteners.

1507.9.7 Application. Wood shakes shall be laid with a side lap not less than 1.5 inches (38 mm) between joints in adjacent courses. Spacing between shakes in the same course shall be 0.375 to 0.625 inches (9.5 to 15.9 mm) for shakes and taper sawn shakes of naturally durable wood and shall be 0.25 to 0.375 inch (6.4 to 9.5 mm) for preservative taper sawn shakes. Weather exposure for wood shakes shall not exceed those set in Table 1507.9.7.

TABLE 1507.9.7 WOOD SHAKE WEATHER EXPOSURE AND ROOF SLOPE

ROOFING MATERIAL	LENGTH (inches)	GRADE	EXPOSURE (inches) 4:12 PITCH OR STEEPER
Shakes of naturally durable wood	18	No. 1	7.5
	24	No. 1	10[a]
Preservative-treated taper sawn shakes of Southern yellow pine	18	No. 1	7.5
	24	No. 1	10
	18	No. 2	5.5
	24	No. 2	7.5
Taper sawn shakes of naturally durable wood	18	No. 1	7.5
	24	No. 1	10
	18	No. 2	5.5
	24	No. 2	7.5

For SI: 1 inch = 25.4 mm.

a. For 24-inch by 0.375-inch hand split shakes, the maximum exposure is 7.5 inches.

1507.9.8 Flashing. At the juncture of the roof and vertical surfaces, flashing and counterflashing shall be provided in accordance with the manufacturer's installation instructions, and where of metal, shall not be less than 0.019-inch (0.48 mm) (No. 26 galvanized sheet gage) corrosion-resistant metal. The valley flashing shall extend at least 11 inches (279 mm) from the centerline each way and have a splash diverter rib not less than one inch (25 mm) high at the flow line formed as part of the flashing. Sections of flashing shall have an end lap of not less than four inches (102 mm). For roof slopes of three units vertical in 12 units horizontal (25% slope) and over, the valley flashing shall have a 36-inch-wide (914 mm) underlayment of one layer of Type I underlayment running the full length of the valley, in addition to other required underlayment. In areas where the average daily temperature in January is 25°F (-4°C) or less or where there is a possibility of ice forming along the eaves causing a backup of water, the metal valley flashing underlayment shall be solid cemented to the roofing underlayment for slopes under seven units vertical in 12 units horizontal (58% slope).

1507.10 Built-up Roofs. The installation of built-up roofs shall comply with the provisions of 780 CMR 1507.10.

1507.10.1 Slope. Built-up roofs shall have a design slope of a minimum of one-fourth unit vertical in 12 units horizontal (2% slope) for drainage, except for coal-tar built-up roofs that shall have a design slope of a minimum one-eighth unit vertical in 12 units horizontal (15% slope).

1507.10.2 Material Standards. Built-up roof covering materials shall comply with the standards in Table 1507.10.2.

TABLE 1507.10.2 BUILT-UP ROOFING MATERIAL STANDARDS

MATERIAL STANDARD	STANDARD
Acrylic coatings used in roofing	ASTM D 6083
Aggregate surfacing	ASTM D 1863
Asphalt adhesive used in roofing	ASTM D 3747
Asphalt cements used in roofing	ASTM D 3019; D 2822; D 4586
Asphalt-coated glass fiber base sheet	ASTM D 4601
Asphalt coatings used in roofing	ASTM D1227; D 2823; D 4479
Asphalt glass felt	ASTM D 2178
Asphalt primer used in roofing	ASTM D 41
Asphalt-saturated and asphalt-coated organic felt base shee	ASTM D 2626
Asphalt-saturated organic felt (perforated)	ASTM D 226
Asphalt used in roofing	ASTM D 312
Coal-tar cements used in roofing	ASTM D 4022; D 5643
Coal-tar saturated organic felt	ASTM D 227
Coal-tar pitch used in roofing	ASTM D 450; Type I or II
Coal-tar primer used in roofing, damp proofing and waterproofing	ASTM D 43
Glass mat, coal tar	ASTM D 4990
Glass mat, venting type	ASTM D 4897
Mineral-surfaced inorganic cap sheet	ASTM D 3909
Thermoplastic fabrics used in roofing	ASTM D 5665, D 5726

1507.11 Modified Bitumen Roofing. The installation of modified bitumen roofing shall comply with the provisions of 780 CMR 1507.11.

1507.11.1 Slope. Modified bitumen membrane roofs shall have a design slope of a minimum of one-fourth unit vertical in 12 units horizontal (2% slope) for drainage.

1507.11.2 Material Standards. Modified bitumen roof coverings shall comply with CGSB 37-GP-56M, ASTM D 6162, ASTM D 6163, ASTM D 6164, ASTM D 6222, ASTM D 6223 and ASTM D 6298.

1507.12 Thermoset Single-ply Roofing. The installation of thermoset single-ply roofing shall comply with the provisions of 780 CMR 1507.12.

1507.12.1 Slope. Thermoset single-ply membrane roofs shall have a design slope of a minimum of one-fourth unit vertical in 12 units horizontal (2% slope) for drainage.

1507.12.2 Material Standards. Thermoset single-ply roof coverings shall comply with RMA RP-1, RP-2 or RP-3, or ASTM D 4637, ASTM D 5019 or CGSB 37-GP-52M.

1507.13 Thermoplastic Single-ply Roofing. The installation of thermoplastic single-ply roofing shall comply with the provisions of 780 CMR 1507.13.

1507.13.1 Slope. Thermoplastic single-ply membrane roofs shall have a design slope of a minimum of one-fourth unit vertical in 12 units horizontal (2% slope).

1507.13.2 Material Standards. Thermoplastic single-ply roof coverings shall comply with ASTM D 4434 or CGSB 37-GP-54M.

1507.14 Sprayed Polyurethane Foam Roofing. The installation of sprayed polyurethane foam roofing shall comply with the provisions of 780 CMR 1507.14.

1507.14.1 Slope. Sprayed polyurethane foam roofs shall have a design slope of a minimum of one-fourth unit vertical in 12 units horizontal (2% slope) for drainage.

1507.14.2 Material Standards. Spray-applied polyurethane foam insulation shall comply with ASTM C 1029.

1507.14.3 Application. Foamed-in-place roof insulation shall be installed in accordance with the manufacturer's instructions. A liquid-applied protective coating that complies with 780 CMR 1507.15 shall be applied no less than two hours nor more than 72 hours following the application of the foam.

1507.14.4 Foam Plastics. Foam plastic materials and installation shall comply with Chapter 26.

1507.15 Liquid-applied Coatings. The installation of liquid-applied coatings shall comply with the provisions of 780 CMR 1507.15.

1507.15.1 Slope. Liquid-applied roofs shall have a design slope of a minimum of one-fourth unit vertical in 12 units horizontal (2% slope).

1507.15.2 Material Standards. Liquid-applied roof coatings shall comply with ASTM C 836, ASTM C 957, ASTM D 6083, ASTM D 1227 or ASTM D 3468.

780 CMR 1508.0 ROOF INSULATION

1508.1 General. The use of above-deck thermal insulation shall be permitted provided such insulation is covered with an approved roof covering and passes the tests of FM 4450 or UL 1256 when tested as an assembly.

Exception. Foam plastic roof insulation shall conform to the material and installation requirements of 780 CMR 26.00.

1508.1.1 Cellulosic Fiberboard. Cellulosic fiberboard roof insulation shall conform to the material and installation requirements of 780 CMR 23.00.

780 CMR 1509.0 ROOFTOP STRUCTURES

1509.1 General. The provisions of 780 CMR 1509.0 shall govern the construction of rooftop structures.

1509.2 Penthouses. A penthouse or other projection above the roof in structures of other than Type I construction shall not exceed 28 feet (8534 mm) above the roof where used as an enclosure for tanks or for elevators that run to the roof and in all other cases shall not extend more than 18 feet (8534 mm) above the roof. The aggregate area of penthouses and other rooftop structures shall not exceed one-third the area of the supporting roof. A penthouse, bulkhead or any other similar projection above the roof shall not be used for purposes other than shelter of mechanical equipment or shelter of vertical shaft openings in the roof. Provisions such as louvers, louver blades or flashing shall be made to protect the mechanical equipment and the building interior from the elements. Penthouses or bulkheads used for purposes other than permitted by 780 CMR 1507.2 shall conform to the requirements of 780 CMR for an additional story. The restrictions of 780 CMR 1509.2 shall not prohibit the placing of wood flagpoles or similar structures on the roof of any building.

1509.2.1 Type of Construction. Penthouses shall be constructed with walls, floors and roof as required for the building.

Exceptions:

1. On buildings of Type I and II construction, the exterior walls and roofs of penthouses with a fire separation distance of more than five feet (1524 mm) and less than 20 feet (6096 mm) shall be of at least one-hour fire-resistance-rated noncombustible construction. Walls and

roofs with a fire separation distance of 20 feet (6096 mm) or greater shall be of noncombustible construction. Interior framing and walls shall be of noncombustible construction.

2. On buildings of Type III, IV and V construction, the exterior walls of penthouses with a fire separation distance of more than five feet (1524 mm) and less than 20 feet (6096 mm) shall be at least one-hour fire-resistance-rated construction. Walls with a fire separation distance of 20 feet (6096 mm) or greater from a common property line shall be of Type IV or noncombustible construction. Roofs shall be constructed of materials and fire-resistance rated as required in Table 601. Interior framing and walls shall be Type IV or noncombustible construction.

3. Unprotected noncombustible enclosures housing only mechanical equipment and located with a minimum fire separation distance of 20 feet (6096 mm) shall be permitted.

4. On one-story buildings, combustible unroofed mechanical equipment screens, fences or similar enclosures are permitted where located with a fire separation distance of at least 20 feet (6096 mm) from adjacent property lines and where not exceeding four feet (1219 mm) in height above the roof surface.

5. Dormers shall be of the same type of construction as the roof on which they are placed, or of the exterior walls of the building.

1509.3 Tanks. Tanks having a capacity of more than 500 gallons (2 m^3) placed in or on a building shall be supported on masonry, reinforced concrete, steel or Type IV construction provided that, where such supports are located in the building above the lowest story, the support shall be fire-resistance rated as required for Type IA construction.

1509.3.1 Valve. Such tanks shall have in the bottom or on the side near the bottom, a pipe or outlet, fitted with a suitable quick opening valve for discharging the contents in an emergency through an adequate drain.

1509.3.2 Location. Such tanks shall not be placed over or near a line of stairs or an elevator shaft, unless there is a solid roof or floor underneath the tank.

1509.3.3 Tank Cover. Unenclosed roof tanks shall have covers sloping toward the outer edges.

1509.4 Cooling Towers. Cooling towers in excess of 250 square feet (23.2 m^2) in base area or in excess of 15 feet (4572 mm) high where located on buildings more than 50 feet (15 240 mm) high shall be of noncombustible construction. Cooling towers shall not exceed one-third of the supporting roof area.

Exception. Drip boards and the enclosing construction of wood not less than one inch (25 mm) nominal thickness, provided the wood is covered on the exterior of the tower with noncombustible material.

1509.5 Towers, Spires, Domes and Cupolas. Any tower, spire, dome or cupola shall be of a type of construction not less in fire-resistance rating than required for the building to which it is attached except that any such tower, spire, dome or cupola that exceeds 85 feet (25 908 mm) in height above grade, or exceeds 200 square feet (18.6 m^2) in horizontal area or is used for any purpose other than a belfry or an architectural embellishment shall be constructed of and supported on Type I or II construction.

1509.5.1 Noncombustible Construction Required. Any tower, spire, dome or cupola that exceeds 60 feet (18 288) in height above the highest point at which it comes in contact with the roof, or that exceeds 200 square feet (18.6 m^2) in area at any horizontal section, or which is intended to be used for any purpose other than a belfry or architectural embellishment, shall be entirely constructed of and supported by noncombustible materials. Such structures shall be separated from the building below by construction having a fire-resistance rating of not less than 1.5 hours with openings protected with a minimum 1.5-hour fire-protection rating. Structures, except aerial supports 12 feet (3658 mm) high or less, flagpoles, water tanks and cooling towers, placed above the roof of any building more than 50 feet (15 240 mm) in height, shall be of noncom-bustible material and shall be supported by construction of noncombustible material.

1509.5.2 Towers and Spires. Towers and spires where enclosed shall have exterior walls as required for the building to which they are attached. The roof covering of spires shall be of a class of roof covering as required for the main roof of the rest of the structure.

780 CMR 1510.0 REROOFING

1510.1 General. Materials and methods of application used for recovering or replacing an existing roof covering shall comply with the requirements of 780 CMR 15.00.

Exception. Reroofing shall not be required to meet the minimum design slope requirement of one-quarter unit vertical in 12 units horizontal (2% slope) in 780 CMR 1507 for roofs that provide positive roof drainage.

1510.2 Structural and Construction Loads. Structural roof components shall be capable of supporting the roof-covering system and the material and equipment loads that will be encountered during installation of the system.

1510.3 Recovering Versus Replacement. New roof coverings shall not be installed without first removing all existing layers of roof coverings where any of the following conditions occur:

1. Where the existing roof or roof covering is water soaked or has deteriorated to the point that the existing roof or roof covering is not adequate as a base for additional roofing.
2. Where the existing roof covering is wood shake, slate, clay, cement or asbestos-cement tile.
3. Where the existing roof has two or more applications of any type of roof covering.

Exceptions:

1. Complete and separate roofing systems, such as standing-seam metal roof systems, that are designed to transmit the roof loads directly to the building's structural system and that do not rely on existing roofs and roof coverings for support, shall not require the removal of existing roof coverings.
2. Metal panel, metal shingle, and concrete and clay tile roof coverings shall be permitted to be installed over existing wood shake roofs when applied in accordance with 780 CMR 1510.4.

1510.4 Roof Recovering. Where the application of a new roof covering over wood shingle or shake roofs creates a combustible concealed space, the entire existing surface shall be covered with gypsum board, mineral fiber, glass fiber or other approved materials securely fastened in place.

1510.5 Reinstallation of Materials. Existing slate, clay or cement tile shall be permitted for reinstallation, except that damaged, cracked or broken slate or tile shall not be reinstalled. Existing vent flashing, metal edgings, drain outlets, collars and metal counterflashings shall not be reinstalled where rusted, damaged or deteriorated. Aggregate surfacing materials shall not be reinstalled.

1510.6 Flashings. Flashings shall be reconstructed in accordance with approved manufacturer's installation instructions. Metal flashing to which bituminous materials are to be adhered shall be primed prior to installation.

NON-TEXT PAGE

780 CMR 16.00

STRUCTURAL DESIGN

780 CMR 16.00 is unique to Massachusetts

780 CMR 1601.0 GENERAL

1601.1 Scope. Provisions of 780 CMR 16.00 shall govern the structural design of buildings, structures and portions thereof regulated by 780 CMR.

1601.2 Massachusetts Building Code for One- and Two Family Dwellings. Where structural design for buildings covered by the Massachusetts Building Code for One- and Two Family Dwellings is performed by a registered design professional (RDP), said RDP may follow the structural design provisions of the Massachusetts Basic Building Code in lieu of those in the Building Code for One- and Two Family Dwellings, and shall follow the Basic Building Code for the structural design of components and systems not addressed in the Building Code for One- and Two Family Dwellings.

780 CMR 1602.0 DEFINITIONS AND NOTATIONS

1602.1 Definitions. The following words and terms shall, for the purposes of 780 CMR 16.00, have the meanings shown in 780 CMR 1602.0. For definitions not contained in 780 CMR 1602.0, see appropriate sections of ASCE 7.

ALLOWABLE STRESS DESIGN. A method of proportioning structural members, such that elastically computed stresses produced in the members by nominal loads do not exceed specified allowable stresses (also called working stress design).

BALCONY. A floor projecting from and supported by a structure without additional independent supports.

DEAD LOADS. The weight of materials of construction incorporated into the building, including but not limited to walls, floors, roofs, ceilings, stairways, built-in partitions, finishes, cladding, and other similarly incorporated architectural and structural items, and fixed service equipment, including the weight of cranes. All dead loads are considered permanent loads.

DECK. An exterior floor supported on at least two opposing sides by an adjacent structure, and/or posts, piers or other independent supports.

DESIGN STRENGTH. The product of the nominal strength and a resistance factor (or strength reduction factor).

DURATION OF LOAD. The period of continuous application of a given load, or the aggregate of periods of intermittent applications of the same load.

EQUIPMENT SUPPORT. Those structural members or assemblies of members or manufactured elements, including braces, frames, lugs, snuggers, hangers or saddles, that transmit gravity load and operating load between the equipment and the structure.

ESSENTIAL FACILITIES. Buildings and other structures that are intended to remain operational in the event of extreme environmental loading from flood, wind, snow or earthquakes.

FACTORED LOAD. The product of a nominal load and a load factor.

FLEXIBLE EQUIPMENT CONNECTIONS. Those connections between equipment components that permit rotational and/or translational movement without degradation of performance.

GUARD. See 780 CMR 1002.1.

IMPACT LOAD. The load resulting from moving machinery, elevators, craneways, vehicles, and other similar forces and kinetic loads, pressure and possible surcharge from fixed or moving loads.

JOINT. A portion of a column bounded by the highest and lowest surfaces of the other members framing into it.

LATERAL FORCE-RESISTING SYSTEM. That part of the structural system that is considered in the design to provide resistance to the wind and seismic forces prescribed in 780 CMR.

LIMIT STATE. A condition beyond which a structure or member becomes unfit for service and is judged to be no longer useful for its intended function (serviceability limit state) or to be unsafe (strength limit state).

LIVE LOADS. Those loads produced by the use and occupancy of the building or other structure and do not include construction or environmental loads such as wind load, snow load, rain load, earthquake load, flood load or dead load.

LIVE LOADS (ROOF). Those loads produced (1) during maintenance by workers, equipment and materials; and (2) during the life of the structure by movable objects such as planters and by people.

LOAD AND RESISTANCE FACTOR DESIGN (LRFD). A method of proportioning structural members and their connections using load and resistance factors such that no applicable limit state is reached when the structure is subjected to appropriate load combinations. (Also called "strength design").

LOAD FACTOR. A factor that accounts for deviations of the actual load from the nominal load, for uncertainties in the analysis that transforms the load into a load effect, and for the probability that more than one extreme load will occur simultaneously.

LOADS. Forces or other actions that result from the weight of building materials, occupants and their possessions, environmental effects, differential movement, and restrained dimensional changes. Permanent loads are those loads in which variations over time are rare or of small magnitude, such as dead loads. All other loads are variable loads (see also "Nominal loads").

LOADS EFFECTS. Forces and deformations produced in structural members by the applied loads.

NOMINAL LOADS. The magnitudes of the loads specified in 780 CMR 16.00 (dead, live, soil, wind, snow, rain, flood and earthquake).

NOTATIONS:

D = Dead load.

E = Combined effect of horizontal and vertical earthquake- induced forces.

F = Load due to fluids.

F_a = Flood load.

H = Load due to lateral pressure of soil and water in soil.

L = Live load, except roof live load, including any permitted live load reduction.

L_r = Roof live load including any permitted live load reduction.

R = Rain load.

S = Snow load.

T = Self-straining force arising from contraction or expansion resulting from temperature change, shrinkage, moisture change, creep in component materials, movement due to differential settlement, or combinations thereof.

W = Load due to wind pressure.

P-DELTA EFFECT. The second order effect on shears, axial forces and moments of frame members induced by gravity loads on a laterally displaced building frame.

PANEL (PART OF A STRUCTURE). The section of a floor, wall or roof comprised between the supporting frame of two adjacent rows of columns and girders or column bands of floor or roof construction.

RESISTANCE FACTOR. A factor that accounts for deviations of the actual strength from the nominal strength and the manner and consequences of failure (also called strength reduction factor).

SHALLOW ANCHORS. Shallow anchors are those with embedment length-to-diameter ratios of less than 8.

SHEAR PANEL. A floor, roof or wall component sheathed to act as a shear wall or diaphragm.

SHEAR WALL. A wall designed to resist lateral forces parallel to the plane of the wall.

STRENGTH, NOMINAL. The capacity of a structure or member to resist the effects of loads, as determined by computations using specified material strengths and dimensions and formulas derived from accepted principles of structural mechanics or by field tests or laboratory tests of scaled models, allowing for modeling effects and differences between laboratory and field conditions.

STRENGTH, REQUIRED. Strength of a member, cross section or connection required to resist factored loads or related internal moments and forces in such combinations as stipulated by these provisions.

STRENGTH DESIGN. A method of proportioning structural members such that the computed forces produced in the members by factored loads do not exceed the member design strength (also called load and resistance factor design).

WALL, LOAD BEARING. Any wall meeting either of the following classifications:

1. Any metal or wood stud wall that supports more than 100 pounds per linear foot (1459 N/m) of vertical load in addition to its own weight.
2. Any masonry or concrete wall that supports more than 200 pounds per linear foot (2919 N/m) of vertical load in addition to its own weight.

WALL, NONLOAD BEARING. Any wall that is not a load-bearing wall.

780 CMR 1603.0 CONSTRUCTION DOCUMENTS

1603.1 General. Construction documents shall show the size, section and relative locations of structural members with floor levels, column centers and offsets fully dimensioned. The design loads and other information pertinent to the structural design required by 780 CMR 1603.1.1 through 1603.1.8 shall be clearly indicated on the construction documents for parts of the building or structure.

1603.1.1 Floor Live Load. The uniformly distributed, concentrated, and impact floor live loads used in the design and where they are applied shall be indicated. Also, whether live load reduction has been applied. shall be indicated.

1603.1.2 Roof Live Load. The roof live load used in the design shall be indicated (780 CMR 1607.11).

1603.1.3 Roof Snow Load. The ground snow load, p_g, and the flat-roof snow load, p_f, and, if applicable, the sloped roof snow load, p_s, shall be indicated.

1603.1.4 Wind Load. The following information related to wind loads shall be shown, regardless of whether wind loads govern the design of the lateral-force resisting system of the building:

1. Basic wind speed (three-second gust), miles per hour (km/hr).
2. Wind importance factor, I_W, and building category.
3. Wind exposure. If more than one wind exposure is utilized, the wind exposures and applicable wind directions shall be indicated.

1603.1.5 Earthquake Design Data. The following information related to seismic loads shall be shown, regardless of whether seismic loads govern the lateral design of the building:

1. Seismic importance factor, I_E, and seismic use group.
2. Mapped spectral response accelerations S_S and S_1.
3. Site class.
4. Spectral response coefficients S_{DS} and S_{D1}.
5. Seismic design category.
6. Basic seismic-force-resisting system(s).
7. Design base shear.
8. Seismic response coefficient(s), C_S.
9. Response modification factor(s), R.
10. Analysis procedure used.

Where the information along different horizontal axes of the building is different, the information for both orthogonal axes shall be show.

1603.1.6 Flood Load. For buildings located in flood-hazard areas, the design flood elevation and whether or not the construction is subject to high-velocity wave action shall be indicated. The following information, referenced to the datum on the community's flood insurance rate map (FIRM), shall be shown, regardless of whether flood loads govern the design of the building:

1. In flood-hazard areas not subject to high-velocity wave action, the elevation of proposed lowest floor, including basement.
2. In flood-hazard areas not subject to high-velocity wave action, the elevation to which any nonresidential building will be dry floodproofed.
3. In flood-hazard areas subject to high-velocity wave action, the proposed elevation of the bottom of the lowest horizontal structural member of the lowest floor, including basement.

1603.1.7 Special Loads. Special loads that are applicable to the design of the building, structure or portions thereof shall be indicated.

1603.2 Structural Designs under the Control of the Construction Contractor. When structural components, assemblies, or systems are designed by design professionals under the control of the contractor, and said designs are not included with the application for permit, said designs shall be submitted to the building official with an application for amendment of the permit.

780 CMR 1604.0 GENERAL DESIGN REQUIREMENTS

1604.1 General. Building, structures, and parts thereof shall be designed and constructed in accordance with strength design (also known as load and resistance factor design), allowable stress design, or empirical design, as permitted by the applicable material chapters.

1604.2 Strength. Buildings and other structures, and parts thereof, shall be designed and constructed to support safely the factored loads in load combinations defined in 780 CMR without exceeding the appropriate strength limit states for the materials of construction. Alternatively, buildings and other structures, and parts thereof, shall be designed and constructed to support safely the nominal loads in load combinations defined in 780 CMR without exceeding the appropriate specified allowable stresses for the materials of construction.

Loads and forces for occupancies or uses not covered in 780 CMR 16.00 shall be subject to the approval of the building official.

1604.3 Serviceability. Structural systems and members thereof shall be designed to have adequate stiffness to limit deflections and lateral drift.

1604.3.1 Deflections. The deflections of structural members shall not exceed the limitations of 780 CMR 1604.3.2 through 1604.3.5, as applicable; however, under no circumstance shall the deflections from gravity loads on floors or roofs exceed 1/240th of the span, nor shall the deflections of walls due to lateral loads exceed 1/180th of the span.

1604.3.2 Reinforced Concrete. The deflection of reinforced concrete structural members shall not exceed that permitted by ACI 318.

1604.3.3 Steel. The deflection of steel structural members shall not exceed that permitted by AISC LRFD, AISC HSS, AISC 335, AISI -NASPEC, AISI-General, AISI-Truss, ASCE 3, ASCE 8-SSD-LRFD/ASD, and the standard specifications of SJI Standard Specifications, Load Tables and Weight Tables for Steel Joists and Joist Girders as applicable.

1604.3.4 Masonry. The deflection of masonry structural members shall not exceed that permitted by ACI 530/ASCE 5/TMS 402.

1604.3.5 Aluminum. The deflection of aluminum structural members shall not exceed that permitted by AA-94.

1604.4 Analysis. Load effects on structural members and their connections shall be determined by methods of structural analysis that take into account equilibrium, general stability, geometric compatibility, and both short- and long-term material properties.

Members that tend to accumulate residual deformations under repeated service loads shall have included in their analysis the added eccentricities expected to occur during their service life.

Any system or method of construction to be used shall be based on a rational analysis in accordance with well-established principles of mechanics. Such analysis shall result in a system that provides a complete load path capable of transferring loads from their point of origin to the load-resisting elements.

The total lateral force shall be distributed to the various vertical elements of the lateral-force-resisting system in proportion to their rigidities considering the rigidity of the horizontal bracing system or diaphragm. Rigid elements that are assumed not to be a part of the lateral-force-resisting system shall be permitted to be incorporated into buildings provided that their effect on the action of the system is considered and provided for in design. Provisions shall be made for the increased forces induced on resisting elements of the structural system resulting from torsion due to eccentricity between the center of application of the lateral forces and the center of rigidity of the lateral-force-resisting system.

Every structure shall be designed to resist the overturning effects caused by the lateral forces specified in 780 CMR 16.00. See 780 CMR 1613 for earthquake, 780 CMR 1609.0 for wind, and 780 CMR 1610.0 for lateral soil loads.

1604.5 Importance Factors. Importance factors shall be in accordance with ASCE 7.

1604.6 *In-situ* Load Tests. The building official is authorized to require an engineering analysis or a load test, or both, of any construction whenever there is reason to question the safety of the construction for the intended occupancy. Engineering analysis and load tests shall be conducted in accordance with 780 CMR 1624.0.

1604.7 Preconstruction Load Tests. Materials and methods of construction that are not capable of being designed by approved engineering analysis or that do not comply with the applicable material design standards listed in 780 CMR 35.00, or alternative test procedures in accordance with 780 CMR 1625.0, shall be load tested in accordance with 780 CMR 1626.0.

1604.8 Overturning, Sliding, and Anchorage.

1604.8.1 General. Anchorage of the roof to walls and columns, and of walls and columns to foundations, shall be provided to resist the uplift and sliding forces that result from the application of the prescribed loads. Foundations shall be capable of resisting applied uplift and sliding forces.

1604.8.2 Concrete and Masonry Walls. Concrete and masonry walls shall be connected to floors, roofs and other structural elements that provide lateral support for the wall. Such anchorage shall provide a positive direct connection capable of resisting the horizontal forces specified in 780 CMR 16.00 but not less than a minimum horizontal force of 190 pounds per linear foot (2.77 kN/m) of wall for allowable stress design, and 280 pounds per lineal foot (4.09 kN/m) of wall for strength design. Walls shall be designed to resist bending between anchors where the anchor spacing exceeds four feet (1219 mm). Required anchors in masonry walls of hollow units or cavity walls shall be embedded in a reinforced grouted structural element of the wall.

1604.9 Application and Posting of Live Loads.

1604.9.1 Restrictions on Loading. It shall be unlawful to place, or cause or permit to be placed, on any floor or roof of a building, structure, or portion thereof, a load greater than the capacity of the floor or roof determined in accordance with the requirements of 780 CMR.

1604.9.2 Live Loads Posted: All buildings in Use Groups F and S shall be conspicuously posted for live loads by the owner, using durable signs. It shall be unlawful to remove or deface such notices.

1604.10 Snow, Wind, and Earthquake Design Factors: Ground snow load, p_g, basic wind speed (three second gust speed), V, and earthquake response accelerations for the maximum considered earthquake, S_S and S_1, for each city and town in Massachusetts shall be as given in Table 1604.10.

NOTE: Table 1604.10 Ground Sow Loads; Basic Wind Speeds; Earthquake Design Factors applies, as applicable, to all use groups except for R-3 One- and Two-family dwellings.

For ground snow loads and basic wind speeds for R-3 of three stories or less one- and two-family stand alone dwellings, *see* 780 CMR 53.00.

TABLE 1604.10 GROUND SNOW LOADS; BASIC WIND SPEEDS; EARTHQUAKE DESIGN FACTORS

(For R-3 of three stories or less one- and two-family stand alone buildings, see 780 CMR 53.00 for snow and wind loads)

City/Town	Ground Snow Load p_g, psf	Basic Wind Speed V, MPH	Earthquake Design Factors	
			Ss	S_1
Abington	45	110	0.26	0.064
Acton	55	100	0.29	0.071
Acushnet	45	110	0.23	0.058
Adams	65	90	0.22	0.068
Agawam	55	100	0.23	0.065
Alford	65	90	0.22	0.066
Amesbury	55	110	0.35	0.077
Amherst	55	100	0.23	0.067
Andover	55	110	0.32	0.075
Aquinnah (see Gay Head)				
Arlington	45	105	0.29	0.069
Ashburnham	65	100	0.27	0.072
Ashby	65	100	0.28	0.072
Ashfield	65	100	0.22	0.068
Ashland	55	100	0.25	0.066
Athol	65	100	0.25	0.070
Attleboro	55	110	0.24	0.062
Auburn	55	100	0.23	0.065
Avon	55	100	0.26	0.064
Ayer	65	100	0.28	0.071
Barnstable	35	120	0.20	0.054
Barre	55	100	0.24	0.068
Becket	65	90	0.22	0.066
Bedford	55	100	0.29	0.071
Belchertown	55	100	0.23	0.066
Bellingham	55	100	0.24	0.064
Belmont	45	105	0.28	0.069
Berkley	55	110	0.24	0.061
Berlin	55	100	0.26	0.068
Bernardston	65	100	0.23	0.070
Beverly	45	110	0.32	0.072
Billerica	55	100	0.30	0.072
Blackstone	65	100	0.24	0.064
Blandford	65	100	0.23	0.066
Bolton	55	100	0.26	0.069
Boston	45	105	0.29	0.068
Bourne	35	120	0.21	0.056
Boxborough	55	100	0.28	0.070
Boxford		110	0.33	0.075
Boylston	55	100	0.25	0.067
Braintree	45	105	0.27	0.066
Brewster	35	120	0.18	0.052
Bridgewater	45	110	0.24	0.062
Brimfield	55	100	0.23	0.065
Brockton	45	110	0.25	0.064
Brookfield	55	100	0.23	0.065
Brookline	45	105	0.28	0.068
Buckland	65	100	0.22	0.068
Burlington	55	105	0.30	0.071

TABLE 1604.10 GROUND SNOW LOADS; BASIC WIND SPEEDS; EARTHQUAKE DESIGN FACTORS

(For R-3 of three stories or less one- and two-family stand alone buildings, see 780 CMR 53.00 for snow and wind loads)

City/Town	**Ground Snow Load p_g, psf**	**Basic Wind Speed V, MPH**	**Earthquake Design Factors**	
			Ss	**S_1**
Cambridge	45	105	0.28	0.068
Canton	55	100	0.26	0.066
Carlisle	55	100	0.29	0.071
Carver	45	110	0.24	0.060
Charlemont	65	100	0.22	0.068
Charlton	55	100	0.23	0.065
Chatham	35	120	0.17	0.050
Chelmsford	55	100	0.30	0.073
Chelsea	45	105	0.29	0.069
Cheshire	65	90	0.22	0.068
Chester	65	100	0.22	0.066
Chesterfield	65	100	0.22	0.067
Chicopee	55	100	0.23	0.066
Chilmark	35	120	0.18	0.051
Clarksburg	65	90	0.22	0.069
Clinton	55	100	0.26	0.068
Cohasset	45	110	0.27	0.066
Colrain	65	100	0.23	0.069
Concord	55	100	0.29	0.070
Conway	65	100	0.22	0.068
Cummington	65	100	0.22	0.067
Dalton	65	90	0.22	0.067
Danvers	45	110	0.32	0.073
Dartmouth	45	110	0.23	0.058
Dedham	55	100	0.26	0.066
Deerfield	65	100	0.23	0.068
Dennis	35	120	0.19	0.052
Dighton	55	110	0.24	0.061
Douglas	55	100	0.23	0.064
Dover	55	100	0.26	0.066
Dracut	55	100	0.33	0.075
Dudley	55	100	0.23	0.064
Dunstable	65	100	0.31	0.074
Duxbury	45	110	0.25	0.062
East Bridgewater	45	110	0.25	0.063
East Brookfield	55	100	0.23	0.066
East Longmeadow	55	100	0.23	0.065
Eastham	35	120	0.19	0.052
Easthampton	55	100	0.23	0.066
Easton	55	110	0.25	0.064
Edgartown	35	120	0.18	0.050
Egremont	65	90	0.23	0.066
Erving	65	100	0.23	0.069
Essex	45	110	0.33	0.073
Everett	45	105	0.29	0.069
Fairhaven	45	110	0.22	0.057
Fall River	45	110	0.23	0.059
Falmouth	35	120	0.20	0.054
Fitchburg	65	100	0.27	0.071
Florida	65	90	0.22	0.069

TABLE 1604.10 GROUND SNOW LOADS; BASIC WIND SPEEDS; EARTHQUAKE DESIGN FACTORS

(For R-3 of three stories or less one- and two-family stand alone buildings, see 780 CMR 53.00 for snow and wind loads)

City/Town	Ground Snow Load p_g, psf	Basic Wind Speed V, MPH	Earthquake Design Factors	
			Ss	S_1
Foxborough	55	100	0.25	0.064
Framingham	55	100	0.26	0.067
Franklin	55	100	0.24	0.064
Freetown	45	110	0.23	0.060
Gardner	65	100	0.26	0.070
Gay Head (a.k.a Aquinnah)	35	120	0.18	0.051
Georgetown	55	110	0.34	0.075
Gill	65	100	0.23	0.069
Gloucester	45	110	0.33	0.073
Goshen	65	100	0.22	0.067
Gosnold	35	120	0.19	0.053
Grafton	55	100	0.24	0.066
Granby	55	100	0.23	0.066
Granville	65	100	0.23	0.066
Great Barrington	65	90	0.22	0.066
Greenfield	65	100	0.23	0.069
Groton	65	100	0.30	0.073
Groveland	55	110	0.34	0.076
Hadley	55	100	0.23	0.067
Halifax	45	110	0.25	0.062
Hamilton	45	110	0.33	0.074
Hampden	55	100	0.23	0.065
Hancock	65	90	0.22	0.068
Hanover	45	110	0.26	0.064
Hanson	45	110	0.25	0.063
Hardwick	55	100	0.23	0.067
Harvard	55	100	0.28	0.070
Harwich	35	120	0.18	0.051
Hatfield	55	100	0.22	0.067
Haverhill	55	110	0.35	0.077
Hawley	65	100	0.22	0.068
Heath	65	100	0.22	0.069
Hingham	45	110	0.27	0.066
Hinsdale	65	90	0.22	0.067
Holbrook	45	105	0.26	0.065
Holden	55	100	0.25	0.068
Holland	55	100	0.23	0.064
Holliston	55	100	0.25	0.066
Holyoke	55	100	0.23	0.066
Hopedale	55	100	0.24	0.065
Hopkinton	55	100	0.25	0.066
Hubbardston	65	100	0.25	0.069
Hudson	55	100	0.26	0.068
Hull	45	110	0.28	0.067
Huntington	65	100	0.22	0.066
Ipswich	45	110	0.34	0.074
Kingston	45	110	0.24	0.061
Lakeville	45	110	0.24	0.061
Lancaster	55	100	0.27	0.070
Lanesborough	65	90	0.22	0.068

TABLE 1604.10 GROUND SNOW LOADS; BASIC WIND SPEEDS; EARTHQUAKE DESIGN FACTORS

(For R-3 of three stories or less one- and two-family stand alone buildings, see 780 CMR 53.00 for snow and wind loads)

City/Town	Ground Snow Load p_g, psf	Basic Wind Speed V, MPH	Earthquake Design Factors	
			Ss	S_1
Lawrence	55	110	0.33	0.075
Lee	65	90	0.22	0.066
Leicester	55	100	0.24	0.066
Lenox	65	90	0.22	0.067
Leominster	65	100	0.26	0.070
Leverett	65	100	0.23	0.068
Lexington	55	105	0.29	0.070
Leyden	65	100	0.23	0.069
Lincoln	55	100	0.28	0.069
Littleton	55	100	0.29	0.071
Longmeadow	55	100	0.23	0.065
Lowell	55	100	0.31	0.074
Ludlow	55	100	0.23	0.066
Lunenburg	65	100	0.28	0.071
Lynn	45	110	0.31	0.071
Lynnfield	45	110	0.31	0.072
Malden	45	105	0.29	0.069
Manchester	45	110	0.32	0.072
Mansfield	55	110	0.25	0.063
Marblehead	45	110	0.31	0.071
Marion	45	110	0.22	0.057
Marlborough	55	100	0.26	0.068
Marshfield	45	110	0.26	0.064
Mashpee	35	120	0.20	0.054
Mattapoisett	45	110	0.22	0.057
Maynard	55	100	0.27	0.069
Medfield	55	100	0.25	0.065
Medford	45	105	0.29	0.070
Medway	55	100	0.25	0.065
Melrose	45	105	0.30	0.070
Mendon	55	100	0.24	0.064
Merrimac	55	110	0.35	0.077
Methuen	55	110	0.34	0.076
Middleborough	45	110	0.24	0.061
Middlefield	65	100	0.22	0.066
Middleton	45	110	0.32	0.073
Milford	55	100	0.24	0.065
Millbury	55	100	0.24	0.065
Millis	55	100	0.25	0.065
Millville	55	100	0.24	0.064
Milton	45	105	0.27	0.066
Monroe	65	100	0.22	0.069
Monson	55	100	0.23	0.065
Montague	65	100	0.23	0.068
Monterey	65	90	0.22	0.066
Montgomery	65	100	0.23	0.066
Mount Washington	65	90	0.23	0.066
Nahant	45	110	0.30	0.070
Nantucket	35	120	0.15	0.047
Natick	55	100	0.26	0.067

TABLE 1604.10 GROUND SNOW LOADS; BASIC WIND SPEEDS; EARTHQUAKE DESIGN FACTORS

(For R-3 of three stories or less one- and two-family stand alone buildings, see 780 CMR 53.00 for snow and wind loads)

City/Town	**Ground Snow Load p_g, psf**	**Basic Wind Speed V, MPH**	**Earthquake Design Factors**	
			Ss	S_1
Needham	55	100	0.27	0.067
New Ashford	65	90	0.22	0.068
New Bedford	45	110	0.23	0.058
New Braintree	55	100	0.23	0.067
New Marlborough	65	90	0.23	0.066
New Salem	65	100	0.24	0.068
Newbury	55	110	0.35	0.076
Newburyport	55	110	0.35	0.077
Newton	55	105	0.27	0.068
Norfolk	55	100	0.25	0.065
North Adams	65	90	0.22	0.069
North Andover	55	110	0.33	0.075
North Attleborough	55	110	0.24	0.063
North Brookfield	55	100	0.23	0.066
North Reading	55	105	0.32	0.073
Northampton	55	100	0.22	0.066
Northborough	55	100	0.25	0.067
Northbridge	55	100	0.24	0.065
Northfield	65	100	0.24	0.070
Norton	55	110	0.24	0.063
Norwell	45	110	0.26	0.064
Norwood	55	100	0.26	0.065
Oak Bluffs	35	120	0.18	0.051
Oakham	55	100	0.24	0.067
Orange	65	100	0.24	0.070
Orleans	35	120	0.18	0.051
Otis	65	90	0.23	0.066
Oxford	55	100	0.23	0.065
Palmer	55	100	0.23	0.066
Paxton	55	100	0.24	0.067
Peabody	45	110	0.31	0.072
Pelham	55	100	0.23	0.067
Pembroke	45	110	0.25	0.063
Pepperell	65	100	0.30	0.073
Peru	65	90	0.22	0.067
Petersham	65	100	0.24	0.068
Phillipston	65	100	0.24	0.069
Pittsfield	65	90	0.22	0.067
Plainfield	65	100	0.22	0.068
Plainville	55	100	0.24	0.063
Plymouth	45	110	0.24	0.060
Pympton	45	110	0.24	0.061
Princeton	65	100	0.25	0.069
Provincetown	35	120	0.22	0.058
Quincy	45	105	0.27	0.067
Randolph	45	105	0.26	0.065
Raynham	55	110	0.24	0.062
Reading	55	105	0.31	0.072
Rehoboth	55	110	0.24	0.062
Revere	45	105	0.30	0.070
Richmond	65	90	0.22	0.067

TABLE 1604.10 GROUND SNOW LOADS; BASIC WIND SPEEDS; EARTHQUAKE DESIGN FACTORS

(For R-3 of three stories or less one- and two-family stand alone buildings, see 780 CMR 53.00 for snow and wind loads)

City/Town	Ground Snow Load p_g, psf	Basic Wind Speed V, MPH	Earthquake Design Factors	
			Ss	S_1
Rochester	45	110	0.23	0.059
Rockland	45	110	0.26	0.064
Rockport	45	110	0.33	0.073
Rowe	65	100	0.22	0.069
Rowley	55	110	0.34	0.075
Royalston	65	100	0.25	0.070
Russell	65	100	0.23	0.066
Rutland	55	100	0.24	0.068
Salem	45	110	0.31	0.071
Salisbury	55	110	0.35	0.077
Sandisfield	65	90	0.23	0.066
Sandwich	35	120	0.22	0.058
Saugus	45	110	0.30	0.070
Savoy	65	90	0.22	0.068
Scituate	45	110	0.27	0.065
Seekonk	55	110	0.24	0.062
Sharon	55	100	0.25	0.065
Sheffield	65	90	0.23	0.066
Shelburne	65	100	0.23	0.068
Sherborn	55	100	0.26	0.066
Shirley	65	100	0.28	0.072
Shrewsbury	55	100	0.25	0.067
Shutesbury	65	100	0.23	0.068
Somerset	55	110	0.23	0.060
Somerville	45	105	0.28	0.069
South Hadley	55	100	0.23	0.066
Southampton	55	100	0.23	0.066
Southborough	55	100	0.26	0.067
Southbridge	55	100	0.23	0.064
Southwick	55	100	0.23	0.065
Spencer	55	100	0.23	0.066
Springfield	55	100	0.23	0.065
Sterling	55	100	0.26	0.069
Stockbridge	65	90	0.22	0.066
Stoneham	45	105	0.30	0.071
Stoughton	55	100	0.26	0.065
Stow	55	100	0.27	0.069
Sturbridge	55	100	0.23	0.065
Sudbury	55	100	0.27	0.069
Sunderland	65	100	0.23	0.068
Sutton	55	100	0.24	0.065
Swampscott	45	110	0.30	0.070
Swansea	55	110	0.24	0.061
Taunton	55	110	0.24	0.062
Templeton	65	100	0.25	0.070
Tewksbury	55	100	0.31	0.073
Tisbury	35	120	0.18	0.052
Tolland	65	100	0.23	0.066
Topsfield	45	110	0.33	0.074
Townsend	65	100	0.28	0.072
Truro	35	120	0.22	0.057

TABLE 1604.10 GROUND SNOW LOADS; BASIC WIND SPEEDS; EARTHQUAKE DESIGN FACTORS

(For R-3 of three stories or less one- and two-family stand alone buildings, see 780 CMR 53.00 for snow and wind loads)

City/Town	Ground Snow Load p_g, psf	Basic Wind Speed V, MPH	Earthquake Design Factors	
			Ss	S_1
Tyngsborough	55	100	0.31	0.074
Tyringham	65	90	0.22	0.066
Upton	55	100	0.24	0.065
Uxbridge	55	100	0.24	0.064
Wakefield	45	105	0.31	0.071
Wales	55	100	0.23	0.065
Walpole	55	100	0.25	0.065
Waltham	55	105	0.28	0.069
Ware	55	100	0.23	0.066
Wareham	45	110	0.23	0.058
Warren	55	100	0.23	0.066
Warwick	65	100	0.24	0.070
Washington	65	90	0.22	0.067
Watertown	45	105	0.28	0.068
Wayland	55	100	0.27	0.068
Webster	55	100	0.23	0.064
Wellesley	55	100	0.27	0.067
Wellfleet	35	120	0.20	0.054
Wendell	65	100	0.23	0.069
Wenham	45	110	0.32	0.073
West Boylston	55	100	0.25	0.067
West Bridgewater	45	110	0.25	0.063
West Brookfield	55	100	0.23	0.066
West Newbury	55	110	0.35	0.077
West Springfield	55	100	0.23	0.065
West Stockbridge	65	90	0.22	0.066
West Tisbury	35	120	0.18	0.052
Westborough	55	100	0.25	0.067
Westfield	55	100	0.23	0.066
Westford	55	100	0.30	0.073
Westhampton	65	100	0.22	0.066
Westminster	65	100	0.26	0.071
Weston	55	100	0.27	0.068
Westport	45	110	0.23	0.058
Westwood	55	100	0.26	0.066
Weymouth	45	105	0.27	0.066
Whately	65	100	0.22	0.067
Whitman	45	110	0.25	0.063
Wilbraham	55	100	0.23	0.065
Willamsburg	65	100	0.22	0.067
Williamstown	65	90	0.23	0.069
Wilmington	55	105	0.31	0.073
Winchendon	65	100	0.26	0.071
Winchester	55	105	0.29	0.070
Windsor	65	90	0.22	0.067
Winthrop	45	105	0.29	0.068
Woburn	55	105	0.30	0.071
Worcester	55	100	0.24	0.067
Worthington	65	100	0.22	0.067
Wrentham	55	100	0.24	0.064
Yarmouth	35	120	0.19	0.052

780 CMR 1605.0 LOAD COMBINATIONS

1605.1 General. Buildings and other structures and portions thereof shall be designed to resist the load combinations specified in 780 CMR 1605.2 or 1605.3 and 780 CMR 18.00 through 23.00, and load combinations which include the special seismic load of ASCE 7, Section 9.5.2.7.1, where required by ASCE 7, Section 9.5.2.6.2.11 or 9.5.2.6.3.1. Applicable loads shall be considered, including both earthquake and wind, in accordance with the specified load combinations. Each load combination shall also be investigated with one or more of the variable loads set to zero.

1605.2 Load Combinations Using Strength Design or Load and Resistance Factor Design.

1605.2.1 Basic Load Combinations. Where strength design or load and resistance factor design is used, structures and portions thereof shall resist the most critical effects from the following combinations of factored loads:

EQUATION 16-1

$$1.4\,(D+F)$$

EQUATION 16-2

$$1.2(D+F) + 1.6(L+H) + 0.5(L_r \text{ or } S \text{ or } R)$$

EQUATION 16-3

$$1.2(D+F) + 1.6(L_r \text{ or } S \text{ or } R) + (f_1L \text{ or } 0.8W) + 1.6H$$

EQUATION 16-4

$$1.2D + 1.6W + f_1\,L + 0.5(L_r \text{ or } S \text{ or } R) + 1.6H$$

EQUATION 16-5

$$1.2D + 1.0E + f_1L + 0.5S + 1.6H$$

EQUATION 16-6

$$0.9D + (1.0E \text{ or } 1.6W) + 1.6H$$

where:

f_1 = 1.0 for floors in places of public assembly, for live loads in excess of 100 pounds per square foot (4.79 kN/m^2), and for parking garage live load.

f_1 = 0.5 for other live loads.

Where lateral soil pressure provides resistance to structural actions from other forces, it shall not be included in H, but shall be included in the design resistance.

Exception. Where other factored load combinations are specifically required by the provisions of 780 CMR, such combinations shall take precedence.

1605.2.2 Other Loads.

1605.2.2.1 Load Combinations Including Flood Load. When a structure is included in a flood zone (see 780 CMR 1612.0), the following load combinations shall be considered:

1. In areas subject to high velocity wave action, 1.6W in Equations 16-4 and 16-6 shall be replaced with 1.6W + 2.0 F_a, where F_a is the flood load.
2. In other areas, 1.6W in Equations 16-4 and 16-6 shall be replaced with 0.8W + 1.0 F_a:

Said load combinations are in addition to and shall not replace those of Equations 16-4 and 16-6.

1605.2.2.2 Effects of Temperature and Ponding. The forces and stresses generated by the effects of temperature and ponding shall be considered.

1605.2.2.3 Load Combinations Including Crane Load. 1.6 times the effects of vertical and horizontal crane loads shall be added to Equations 16-2, 16-3, 16-4, and 16-6. When combined with crane loads in these equations:

0.75S may be substituted for S;
0.5W may be substituted for W;
L_r may be taken as 0; and
E may be taken as 0.

(The substituted values shall then be multiplied by the numerical coefficients given in the equations).

1605.3 Load Combinations Using Allowable Stress Design.

1605.3.1 Basic Load Combinations. Where allowable stress design (working stress design), as permitted by 780 CMR, is used, structures and portions thereof shall resist the most critical effects resulting from the following combinations of loads:

EQUATION 16-7

$$D + F$$

EQUATION 16-8

$$D + H + F + L$$

EQUATION 16-9

$$D + H + F + L + (L_r \text{ or } S \text{ or } R)$$

EQUATION 16-10

$$2/3\,[1.2D + (1.6W \text{ or } 1.0E) + f_1\,L + 0.5(L_r \text{ or } S \text{ or } R) + 1.6H]$$

EQUATION 16-11

$$0.6D + W + H$$

EQUATION 16-12

$$0.6D + 0.7E + H$$

where f_1 is defined in 780 CMR 1605.2.1.

Increases in allowable stresses allowed in the various materials standards referenced by the materials chapters of 780 CMR shall not be used, except that a duration of load increase shall be permitted in accordance with 780 CMR 23.00.

Where lateral soil pressure provides resistance to structural actions from other forces, it shall not be included in H, but shall be included in the design resistance.

1605.3.2 Other Loads.

1605.3.2.1 Load Combinations Including Flood Load. When a structure is included in a flood zone (see 780 CMR 1612), the following load combinations shall be considered:

1. In areas subject to high velocity wave action, 1.5 F_a shall be added to other loads in Equations 16-10 and 16-11, where F_a is the flood load, and E shall be set to zero in Equation 16-10.
2. In other areas, 0.75 F_a shall be added to other loads in Equations 16-10 and 16-11, and E shall be set to zero in Equation 16-10.

Said load combinations are in addition to and shall not replace those of Equations 16-10 and 16-11.

1605.3.2.2 Effects of Temperature and Ponding. The forces and stresses generated by the effects of temperature and ponding shall be considered.

1605.3.2.3 Load Combinations Including Crane Load. 1.0 times the effects of vertical and horizontal crane loads shall be added to Equations 16-8, 16-9, 16-10, and 16-12. When combined with crane loads in these equations:

0.75S may be substituted for S;
0.5W may be substituted for W;
L_r may be taken as 0; and
E may be taken as 0.

(The substituted values shall then be multiplied by the numerical coefficients, if any, given in the equations).

1605.4 Heliports and Helistops. Heliport and helistop landing or touchdown areas shall be designed for the following loads, combined in accordance with 780 CMR 1605.0:

1. Dead load, *D*, plus the gross weight of the helicopter, D_h, plus snow load, *S*.
2. Dead load, *D*, plus two single concentrated impact loads, *L*, approximately 8 feet (2438 mm) apart applied anywhere on the touchdown pad (representing each of the helicopter's two main landing gear, whether skid type or wheeled type), having a magnitude of 0.75 times the gross weight of the helicopter. Both loads acting together total 1.5 times the gross weight of the helicopter.
3. Dead load, *D*, plus a uniform live load, *L*, of 100 pounds per square foot (4.79 kN/m^2).

780 CMR 1606.0 DEAD LOADS

1606.1 Weights of Materials and Construction. In determining dead loads for purposes of design, the actual weights of materials and construction shall be used but not less than the applicable minimum design dead loads given in Table C3-1 of ASCE 7. In the absence of definite information, values used shall be subject to the approval of the building official.

1606.2 Weights of Fixed Service Equipment. In determining dead loads for purposes of design, the weight of fixed service equipment, such as plumbing stacks and risers, electrical feeders, heating, ventilating and air conditioning systems and fire sprinkler systems, shall be included.

1606.3 Weight of Concrete Due to Deflection. Account shall be taken of the additional weight of concrete resulting from the deflection of the supporting deck and framing when placing concrete.

1606.4 Weight of Ceilings: Provision shall me made for the weight of ceilings, lights, ducts, and pipes which can be supported within or under the framing of floors or roofs, whether they are presently installed or whether they can be subsequently installed.

780 CMR 1607.0 LIVE LOADS

1607.1 General. Live loads are those loads defined in 780 CMR 1602.1.

1607.2 Loads Not Specified. For occupancies or uses not designated in Table 1607.1, the live load shall be determined in accordance with a method approved by the building official.

1607.3 Uniform Live Loads. The live loads used in the design of buildings and other structures shall be the maximum loads expected by the intended use or occupancy but shall in no case be less than the minimum uniformly distributed unit loads required by Table 1607.1.

TABLE 1607.1 MINIMUM UNIFORMLY DISTRIBUTED LIVE LOADS AND MINIMUM CONCENTRATED LIVE LOADS

OCCUPANCY OR USE	UNIFORM (psf)	CONCENTRATED (lbs.)
1. Apartments (see residential)		
2. Access floor systems		
Office use	50	2,000
Computer use	100	2,000
3. Armories and drill rooms	150	
4. Assembly areas and theaters		
Fixed seats (fastened to floor)	60	
Lobbies	100	
Movable seats	100	
Stages	150	3,000
platforms	100	
Follow spot, projections and control rooms	50	
Catwalks	40	

OCCUPANCY OR USE	UNIFORM (psf)	CONCENTRATED (lbs.)
5. Balconies (exterior)	100	
On one- and two-family residencesonly, and not exceeding 100 ft.^{2}	60	
6. Decks	Same as occupancy served	
7. Bowling alleys	75	
8. Cornices	60	See 780 CMR 1607.11.2.5
9. Corridors, except as otherwise indicated	100	
10. Dance halls and ballrooms	100	
11. Dining rooms and restaurants	100	
12. Dwellings (see residential)		
13. Elevator machine room grating (on area of 4 in.^{2})		300
14. Finish light floor plate construction (on area of 1 in.^{2})		200
15. Fire escapes	100	
On single-family dwellings only	40	
16. Garages (passenger vehicles only)	50	Note a
Trucks and buses	See 780 CMR 1607.6	
17. Grandstands (see stadium and arena bleachers)		
18. Gymnasiums, main floors and balconies	100	
19. Handrails, guards and grab bars	See 780 CMR 1607.7	
20. Hospitals		
Operating rooms, laboratories	100	1,000
Private rooms	40	1,000
Wards	40	1,000
Corridors above first floor	80	1,000
21. Hotels (see residential)		
22. Laboratories	100	2,000
23. Libraries		
Reading rooms	60	1,000
Stack rooms	150^b	1,000
Corridors above first floor	80	1,000
24 Manufacturing		
Light	125	2,000
Heavy	250	3,000
25. Marquees	75	
26. Office buildings		
File and computer rooms shall be designed for heavier loads based on anticipated occupancy		
Lobbies and first-floor corridors	100	2,000
Offices	50	2,000
Corridors above first floor	80	2,000
27. Penal institutions		
Cell blocks	40	
Corridors	100	
28. Residential		
Group R-3		
Uninhabitable attics without storage	10	
Uninhabitable attics with storage	20	
Habitable attics and sleeping areas	30	
All other areas except balconies and decks	40	
Hotels and multifamily dwellings		
Corridors above first floor serving guest rooms	80	
Private rooms	40	
Public rooms and corridors serving them	100	
29. Reviewing stands, grandstands and bleachers	Note c	
30. Roofs	See 780 CMR 1607.11	
31. Schools		
Classrooms	50	1,000
Corridors above first floor	80	1,000
First-floor corridors	100	1,000
32. Scuttles, skylight ribs and accessible ceilings		200
33. Sidewalks, vehicular driveways and yards, subject to trucking	250^d	8,000^e
34. Skating rinks	100	
35. Stadiums and arenas		
Bleachers	100^c	
Fixed seats (fastened to floor)	60^c	
36. Stairs and exits	100	Note f
One- and two-family dwellings	40	
All other	100	
37. Storage warehouses (shall be designed for heavier loads if required for anticipated storage)		
Light	125	
Heavy	250	
38. Stores		
Retail		
First floor	100	1,000
Upper floors	75	1,000
Wholesale, all floors	125	1,000
39. Vehicle barriers	See 780 CMR 1607.7	
40. Walkways and elevated platforms (other than exitways)	60	
41. Yards and terraces, pedestrians	100	

For SI: 1 square inch = 645.16 mm^2, 1 pound per square foot = 0.0479 kN/m^2, 1 pound = 0.004448 kN.

a. Floors in garages or portions of buildings used for the storage of motor vehicles shall be designed for the uniformly distributed live loads of Table 1607.1 or the following concentrated load:
   (1) for passenger cars accommodating not more than nine passengers, 3,000 pounds acting on an area of 4.5 inches by 4.5 inches;
   (2) for mechanical parking structures without slab or deck which are used for storing passenger vehicles only, 2,250 pounds per wheel.

b. The weight of books and shelving shall be computed using an assumed density of 65 pounds per cubic foot and converted to a uniformly distributed load; this load shall be used if it exceeds 150 pounds per square foot. The 150 psf load requirement does not apply to libraries that are incidental to other uses.

c. Design in accordance with the ICC *Standard on Bleachers, Folding and Telescopic Seating and Grandstands*.

d. Other uniform loads in accordance with an approved method which contains provisions for truck loadings shall also be considered where appropriate.

e. The concentrated wheel load shall be applied on an area of 20 square inches.

f. Minimum concentrated load on stair treads (on area of four square inches) is 300 pounds.

g. Where snow loads occur that are in excess of the design conditions, the structure shall be designed to support the loads due to the increased loads caused by drift buildup or a greater snow design determined by the building official. See 780 CMR 1608.0. For special-purpose roofs, see 780 CMR 1607.11.2.2.

1607.4 Concentrated Loads. Floors and other similar surfaces shall be designed to support the uniformly distributed live loads prescribed in 780 CMR 1607.2 or the concentrated load, in pounds (kilonewtons), given in Table 1607.1, whichever produces the greater load effects. Unless otherwise specified, the indicated concentration shall be assumed to be uniformly distributed on a floor or roof over an area of 2.5 feet square [6.25 ft^2 (0.58 m^2)] and shall be located so as to produce the maximum load effects in the structural members. The aforementioned distribution of concentrated load does not apply for concentrated load applied to framing members, scuttles, skylight ribs, hung ceiling supports, cornices, and similar elements for which there is no deck to distribute load.

1607.5 Partition Loads. In office buildings and in other buildings where partition locations are subject to change, provision for partition weight shall be made, whether or not partitions are shown on the construction documents, unless the specified live load exceeds 80 pounds per square foot (3.83 kN/m^2). Such partition load shall not be less than a uniformly distributed live load of 20 pounds per square foot (0.96kN/m^2). Partition loads are non-reducible live load.

1607.6 Truck and Bus Garages. Minimum live loads for garages having trucks or buses shall be as specified in AASHTO Standard for H20-44 and HS20-44 Truck loadings, and for lane loads, but shall not be less than 100 pounds per square foot (4.80 kN/m^2), unless other loads are specifically justified. Actual loads shall be used where they are greater than the above specified loads.

1607.6.1 Truck and Bus Garage Live Load Application. Lane loads shall be applied in aisles and ramps, as specified in AASHTO Standard. Truck loads shall be applied in aisles, ramps, in parking spaces, and berths, in positions that will maximize load effects.

1607.6.2 Horizontal Forces. Longitudinal forces and curb forces shall be as specified in AASHTO Standard. Vehicle barriers shall be designed for a concentrated 10,000 lb lateral force acting at a minimum height of two feet-zero inches above a floor or ramp.

1607.7 Loads on Handrails, Guards, Grab Bars and Vehicle Barriers. Handrails, guards, grab bars, and vehicle barriers shall be designed and constructed to the structural loading conditions set forth in 780 CMR 1607.7.

1607.7.1 Handrails and Guards. Handrail assemblies and guards shall be designed to resist a load of 100 pounds per lineal foot for grandstands, stadia, arenas, and similar structures used for public assembly, and 50 pounds per linear foot (pound per foot) (0.73 kN/m) for other uses, applied in any direction at the top and to transfer this load through the supports to the structure.

Exception. For one- and two-family dwellings, only the single, concentrated load required by 780 CMR 1607.7.1.1 shall be applied.

1607.7.1.1 Concentrated Load. Handrail assemblies and guards shall be able to resist a single concentrated load of 300 pounds for grandstands, stadia, arenas, and similar structures used for public assembly, and 200 pounds (0.89 kN) for other uses, applied in any direction at any point along the top, and have attachment devices and supporting structure to transfer this loading to appropriate structural elements of the building. This load need not be assumed to act concurrently with the loads specified in 780 CMR 1607.7.1.

1607.7.1.2 Components. Intermediate rails (all those except the handrail), balusters and panel fillers shall be designed to withstand a horizontally applied normal load of 200 pounds (0.88 kN) on an area equal to one square foot (305 mm^2) including openings and space between rails. Reactions due to this loading are not required to be superimposed with those of 780 CMR 1607.7.1 or 1607.7.1.1.

1607.7.2 Grab Bars, Shower Seats and Dressing Room Bench Seats. Grab bars, shower seats and dressing room bench seat systems shall be designed to resist a single concentrated load of 250 pounds (1.11 kN) applied in any direction at any point.

1607.7.3 Vehicle Barriers. Vehicle barrier systems for passenger cars shall be designed to resist a single load of 7,000 pounds (31.2 kN) applied horizontally in any direction to the barrier system and shall have anchorage or attachment capable of transmitting this load to the structure. For design of the system, the load shall be assumed to act at a minimum height of one foot, six inches (457 mm) above the floor or ramp surface on an area not to exceed one square foot (305 mm^2), and is not required to be assumed to act concurrently with any handrail or guard loadings specified in the preceding paragraphs of 780 CMR 1607.7.1. Garages accommodating trucks and buses shall be designed in accordance with an approved method that contains provision for traffic railings.

1607.8 Impact Loads. The live loads specified in 780 CMR 1607.2 include allowance for impact conditions. Provision shall be made in the structural design for uses and loads that involve unusual vibration and impact forces.

1607.8.1 Elevators. Structural supports for elevators, dumbwaiters, escalators and moving walks shall be designed for the *loads* and within the limits of the deflection specified in the Board Elevator Regulations (524 CMR 1.0 through 34.0), listed in *780 CMR 35.00*. (In accordance with 524 CMR, all suspended elevator *loads* shall be increased 100% for impact).

1607.8.2 Machinery. For the purpose of design, the weight of machinery and moving loads shall be increased as follows to allow for impact:

1. elevator machinery, 100%;
2. light machinery, shaft- or motor-driven, 20%;
3. reciprocating machinery or power-driven units, 50%.

Percentages shall be increased where specified by the manufacturer.

1607.8.3 Hangers. Live loads on hangers supporting floors, balconies, stairs, walkways, or platforms shall be multiplied by an impact factor of 1.33.

1607.9 Reduction in Live Loads. The minimum uniformly distributed live loads, L_o, in Table 1607.1 are permitted to be reduced according to the 780 CMR 1607.9.1.1 through 1607.9.1.7.

1607.9.1 General. Subject to the limitations of 780 CMR 1607.9.1.1 through 1607.9.1.7, members for which a value of $K_{LL}A_T$ is 400 square feet (37.16 m^2) or more are permitted to be designed for a reduced live load in accordance with the following equation:

EQUATION 16-21

$$L = L_o \left(0.25 + \frac{15}{\sqrt{K_{LL}A_T}} \right)$$

For SI: $$L = L_o \left(0.25 + \frac{4.57}{\sqrt{K_{LL}A_T}} \right)$$

where:

L = Reduced design live load per square foot (meter) of area supported by the member.

L_o = Unreduced design live load per square foot (meter) of area supported by the member (see Table 1607.1).

K_{LL} = Live load element factor (see Table 1607.9.1).

A_T = Tributary area, in square feet (square meters).

L shall not be less than $0.50L_o$ for members supporting one floor and L shall not be less than $0.40L_o$ for members supporting two or more floors.

TABLE 1607.9.1 LIVE LOAD ELEMENT FACTOR K_{LL}

ELEMENT	KLL
Interior columns	4
Exterior columns without cantilever slabs	4
Edge columns with cantilever slabs	3
Corner columns with cantilever slabs	2
Edge beams without cantilever slabs	2
Interior beams	2
All other members not identified above including: Edge beams with cantilever slabs Cantilever beams Two-way slabs Members without provisions for continuous shear transfer normal to their span	1

1607.9.1.1 Heavy Live Loads. Live loads that exceed 100 pounds per foot squared (4.79 kN/m^2) shall not be reduced except the live loads for members supporting two or more floors are permitted to be reduced by a maximum of 20%, but the live load shall not be less than L as calculated in 780 CMR 1607.9.1.

1607.9.1.2 Passenger Car Garages. The live loads shall not be reduced in passenger vehicle garages except the live loads for members supporting two or more floors are permitted to be reduced by a maximum of 20%, but the live load shall not be less than L as calculated in 780 CMR 1607.9.1.

1607.9.1.3 Assembly Occupancies. Live loads of 100 pounds per foot squared (4.79 kN/m^2) or less shall not be reduced in assembly occupancies, except that the live loads for members supporting two or more floors are permitted to be reduced by a maximum of 20%, but the live load shall not be less than *L* as calculated in 780 CMR 1607.9.1.

1607.9.1.4 Special Structural Elements. Live loads shall not be reduced for one-way slabs except as permitted in 780 CMR 1607.9.1.1. Live loads of 100 pound per foot squared (4.79 kN/m^2) or less shall not be reduced for roof members except as specified in 780 CMR 1607.11.2.

1607.9.1.5 Hangers. Live load shall not be reduced for hangers.

1607.9.1.6 Open Web Steel Joists. Live load shall not be reduced for open web steel bar joists.

1607.9.1.7 Concrete Flat Slabs and Plates. Live load shall not be reduced for peripheral (two-way action) shear around columns, capitals, and drop panels of concrete flat slabs, flat plates, and grid slabs.

1607.10 Distribution of Floor Loads. Where uniform floor live loads are involved in the design of structural members arranged so as to create continuity, the minimum applied loads shall be the full dead loads on all spans in combination with the floor live loads on spans selected to produce the greatest effect at each location under consideration. It shall be permitted to reduce floor live loads in accordance with 780 CMR 1607.9.

1607.11 Roof Loads. The structural supports of roofs and marquees shall be designed to resist wind and, where applicable, snow and earthquake loads, in addition to the dead load of construction and the appropriate live loads as prescribed in this 780 CMR, or as set forth in Table 1607.1. The live loads acting on a sloping surface shall be assumed to act vertically on the horizontal projection of that surface.

1607.11.1 Distribution of Roof Loads. Where uniform roof live loads are involved in the design of structural members arranged so as to create continuity, the minimum applied loads shall be the full dead loads on all spans in combination with the roof live loads on adjacent spans or on alternate spans, whichever produces the greatest effect. See 780 CMR 1607.11.2 for minimum roof live loads and ASCE 7, Section 7.5 for partial snow loading.

1607.11.2 Minimum Roof Live Loads. Minimum roof loads shall be determined for the specific conditions in accordance with 780 CMR 1607.11.2.1 through 1607.11.2.5.

1607.11.2.1 Flat, Pitched and Curved Roofs. Ordinary flat, pitched and curved roofs shall be designed for the live loads specified in the following equation or other controlling combinations of loads in 780 CMR 1605.0, whichever produces the greater load. In structures, where special scaffolding is used as a work surface for workers and materials during maintenance and repair operations, a lower roof load than specified in the following equation shall not be used unless approved by the building official. Greenhouses shall be designed for a minimum roof live load of ten pounds per square foot (0.479 kN/m^2).

EQUATION 16-24

$$L_r = 20R_1R_2$$

where: $12 \le L_r \le 20$

For SI: $L_r = 0.96\, R_1R_2$

where: $0.58 \le L_r \le 0.96$

L_r = Roof live load per square foot (m^2) of horizontal projection in pounds per square foot (kN/m^2).

The reduction factors R_1 and R_2 shall be determined as follows:

EQUATION 16-25

$R_1 = 1$ for $A_t \le 200$ square feet (18.58 m^2)

EQUATION 16-26

$R_1 = 1.2 - 0.001A_t$ for 200 square feet $< A_t < 600$ square feet

For SI: $1.2 - 0.011A_t$ for 18.58 square meters $< A_t < 55.74$ square meters

EQUATION 16-27

$R_1 = 0.6$ for $A_t > 600$ square feet (55.74 m^2)

where:

A_t = Tributary area (span length multiplied by effective width) in square feet (m^2) supported by any structural member, and

F = for a sloped roof, the number of inches of rise per foot (for SI: F = 0.12 x slope, with slope expressed in percentage points), and

F = for an arch or dome, rise-to-span ratio multiplied by 32, and

EQUATION 16-28

$R_2 = 1$ for $F \le 4$

EQUATION 16-29

$R_2 = 1.2 - 0.05\,F$ for $4 < F < 12$

EQUATION 16-30

$R_2 = 0.6$ for $F \ge 12$

1607.11.2.2 Special-purpose Roofs. Roofs used for promenade purposes shall be designed for a minimum live load of 60 pounds per square foot (2.87 kN/m^2). Roofs used for roof gardens or assembly purposes shall be designed for a minimum live load of 100 pounds per square foot (4.79 kN/m^2). Roofs used for other special purposes shall be designed for appropriate loads, as directed or approved by the building official.

1607.11.2.3 Landscaped Roofs. Where roofs are to be landscaped, the uniform design live load in the landscaped area shall be 20 pounds per square foot (0.958 kN/m^2). The weight of the landscaping materials shall be considered as dead load and shall be computed on the basis of saturation of the soil.

1607.11.2.4 Awnings and Canopies. Awnings and canopies shall be designed for a uniform live load of five pounds per square foot (0.240 kN/m^2) as well as for snow loads and wind loads as specified in 780 CMR 1608.0 and 1609.0.

1607.11.2.5 Cornices and Overhanging Eaves. Cornices, overhanging eaves and other similar projections shall be designed for a minimum uniform load of 60 pounds per square foot or a load of 100 pounds per lineal foot of projection, whichever gives the most severe structural effect. The linear load shall be positioned to maximize the various structural effects.

1607.12 Crane Loads. The crane live load shall be the rated capacity of the crane. Design loads for the runway beams, including connections and support brackets, of moving bridge cranes and monorail cranes shall include the maximum wheel loads of the crane and the vertical impact, lateral, and longitudinal forces induced by the moving crane.

1607.12.1 Maximum Wheel Load. The maximum wheel loads shall be the wheel loads produced by the weight of the bridge, as applicable, plus the sum of the rated capacity and the weight of the trolley with the trolley positioned on its runway at the location where the resulting load effect is maximum.

1607.12.2 Vertical Impact Force. The maximum wheel loads of the crane shall be increased by the percentages shown below to determine the induced vertical impact or vibration force:

Monorail cranes (powered)	25%
Cab-operated or remotely operated bridge cranes (powered)	25%
Pendant-operated bridge cranes (powered)	10%
Bridge cranes or monorail cranes with hand-geared bridge, trolley and hoist	0%

1607.12.3 Lateral Force. The lateral force on crane runway beams with electrically powered trolleys shall be calculated as 20% of the sum of the rated capacity of the crane and the weight of the hoist and trolley. The lateral force shall be assumed to act horizontally at the traction surface of a runway beam, in either direction perpendicular to the beam, and shall be distributed according to the lateral stiffness of the runway beam and supporting structure.

1607.12.4 Longitudinal Force. The longitudinal force on crane runway beams, except for bridge cranes with hand-geared bridges, shall be calculated as 10% of the maximum wheel loads of the crane. The longitudinal force shall be assumed to act horizontally at the traction surface of a runway beam, in either direction parallel to the beam.

1607.13 Interior Walls and Partitions. Interior walls and partitions, including their finish materials, shall have adequate strength to resist the loads to which they are subjected but not less than a horizontal load of five pounds per square foot (0.240 kN/m^2). Self-supporting portable partitions used in office furnishings are exempt from this requirement.

780 CMR 1608.0 SNOW LOADS

780 CMR 1608.0 is unique to Massachusetts

1608.1 General. Design snow loads shall be determined in accordance with ASCE 7, Section 7, except as provided otherwise in 780CMR 1608.0. The design roof load shall not be less than that determined by 780 CMR 1607.0.

1608.2 Ground Snow Loads. Disregard ASCE 7, Section 7.2, Figure 7.1, and Table 7-1. Ground snow loads, p_g, to be used in the determination of design snow loads for roofs and other surfaces exposed to snow shall be as set forth in 780 CMR 1604.10.

1608.3 Convex Curved Roofs. ASCE 7, Section 7.4.3 applies to convex curved roofs only. *See* 780 CMR 1608.4 for concave curved roofs.

1608.4 Concave Curved Roofs. The effective loaded area of a concave curved roof shall be that area of the surface of the roof where the tangents to the surface have a slope of 50 degrees or less. The total uniform snow load for concave curved roofs shall be the basic snow load, P_f, multiplied by the total horizontal projected area of the roof. This total load shall be applied uniformly over the effective loaded area of the roof.

1608.5 Drifts on Lower Roofs.

1608.5.1 Width of Windward drifts. The width of drift, w, in Figure 7-8 of ASCE 7, shall be eight times the height of the drift (8 times h_d or h_c as applicable) for all windward drifts.

1608.5.2 Multiple Level Roofs. For multiple stepped roofs similar to that shown in Figure 1608.5.1, the sum of all the roof lengths upwind above the drift under consideration, l_u*, in Figure 1608.5.1, shall replace l_u in Figure 7-8 of ASCE 7. For multiple level roofs similar to that shown in Figure 1608.5.2, if the total calculated height of a drift and the underlying uniform snow layer on the upwind side of a higher roof ($h_d + h_b$) is equal to or greater than $0.7h_r$, then the length, l_u*, as shown in Figure 1608.5.2, shall be used in place of l_u in Figure 7-8 of ASCE 7.

FIGURE 1608.5.1 DRIFTING SNOW AT MULTIPLE LEVEL ROOFS

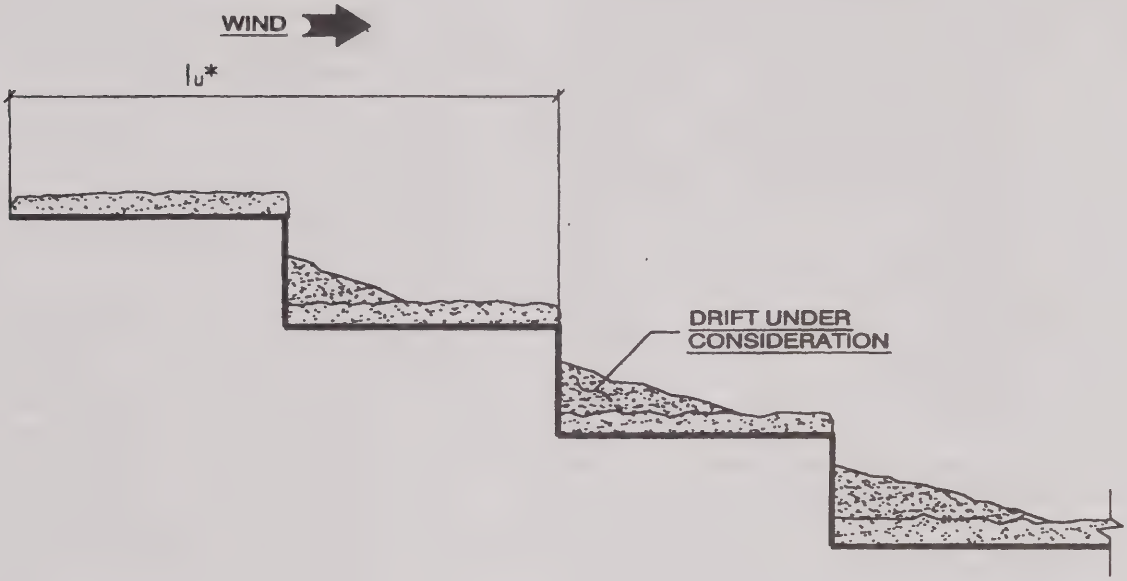
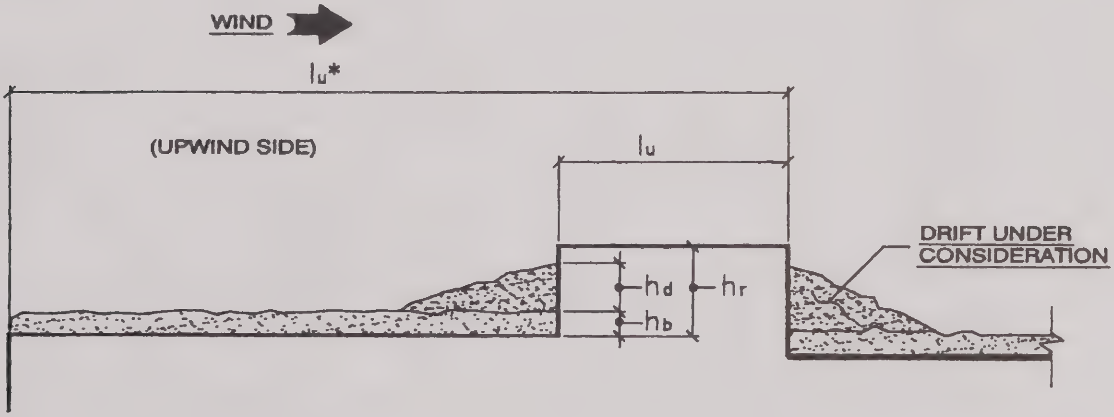

WIND
lu*
DRIFT UNDER CONSIDERATION

FIGURE 1608.5.2 LEEWARD DRIFT AFFECTED BY UPWIND WINDWARD DRIFT


WIND
lu*
(UPWIND SIDE)
lu
hd
hb
hr
DRIFT UNDER CONSIDERATION

1608.5.3 Very High Roof Separations. When the ratio h_r/L_T is greater than 1.0, where L_T is the dimension in feet of the upper roof perpendicular to the wind flow (perpendicular to l_u in Figure 7-8 of ASCE 7), the drift surcharge load on the lower roof due to drifting of snow from the upper roof may be reduced. The reduced height of the drift surcharge, h_{dr}, shall be not less than:

$$h_{dr} = h_r\,(2 - h_r/L_T)$$

except that when h_r/L_T is greater than 2.0, h_{dr} shall be equal to zero.

1608.5.4 Intersecting Drifts. Where there are drifts at walls intersecting at an angle, the unit snow load at any point on the lower roof shall be not less than the greater of the unit loads from the two individual drift surcharges, plus the unit load of the balanced snow load.

1608.5.5 Snow Pockets or Wells. Account shall be taken of the load effects of potentially excessive snow accumulation in pockets or wells of roofs or decks.

1608.6 Roof Projections. The term roof projections used in 780 CMR and In ASCE 7, Section 7.8 shall be interpreted to include screen walls, parapets, fire wall projections, and mechanical equipment. Drift loads at roof projections shall be in accordance with ASCE 7, Section 7.8, except that the width of drift shall be 8 times the height of the drift (eight times h_d or h_c in Figure 7-8, as applicable).

1608.7 Sliding Snow. In addition to the sliding snow load on a lower roof as required in ASCE 7, Section 7.9, the lower roof shall be designed for a windward drift surcharge at the wall separating the upper and lower roofs in accordance with 780 CMR 1608.5.1 and ASCE 7, Section 7.8. The sliding snow load and the windward drift surcharge need not be considered to act concurrently.

1608.7.1 Snow Guards. Sliding snow from an adjacent sloping high roof need not be considered on the low roof if snow guards, as specified in 780 CMR 1608.7.1, are provided on the high roof. In this case, the sloping roof with snow guards shall be designed for the unit snow loads required for a flat roof. Snow guards shall be designed by a registered design professional (RDP) qualified in the structural design of buildings. The design of the snow guards shall be shown on the construction documents. The RDP shall insure that there are adequate load paths from the snow guards into the supporting members and from the supporting members into the structure. The structural design of snow guards shall account for the impact of the sliding snow. The effectiveness in preventing the sliding of snow of proprietary snow guard systems shall be demonstrated by tests.

1608.8 Snow Storage and Collection Areas. Consideration of potentially excessive snow accumulation shall be given to portions of structures designated or used as snow collection or storage areas during and after snow removal operations (e.g. temporary snow collection areas when mechanically removing snow from a roof; snow storage areas for parking structures).

780 CMR 1609 WIND LOADS

780 CMR 1609.0 is unique to Massachusetts

1609.1 General. Design wind loads shall be determined from ASCE 7, Section 6 except as provided otherwise in 780 CMR 1609.0.

1609.1.1 Limit to Wind Tunnel Procedure. Wind loads determined in accordance with ASCE 7, section 6.6 (Method 3) shall have a lower bound of ⅔ of the wind loads determined for Exposure B in accordance with ASCE 7, Section 6.5 (Method 2).

1609.2 Basic Wind Speed and Wind Directionality Factor.

1609.2.1 Basic Wind Speed. In ASCE 7, disregard the body of the text after the section number and title of Section 6.5.4, disregard Subsection 6.5.4.1, and disregard Figure 6-1. The basic wind speed, V, used in the determination of design wind loads on buildings and other structures shall be as given in 780 CMR 1604.10, except as provide in 780 CMR 1609.2.2. V is the nominal three-second gust wind speed in miles per hour at 33 feet (10 m) above ground for Exposure C category. The wind shall be assumed to come from any horizontal direction.

1609.2.2 Estimation of Basic Wind Speeds from Regional Climatic Data. In ASCE 7, Subsection 6.5.4.2, replace "Fig. 6-1" wherever it occurs with "780 CMR 1604.10".

1609.3 Anchorage Against Overturning, Uplift and Sliding. Structural members and systems, and components and cladding in a building or structure shall be anchored to resist wind-induced overturning, uplift and sliding and to provide continuous load paths for these forces to the foundation. Where a portion of the resistance to these forces is provided by dead load, the dead load, including the weight of soils and foundations, shall be taken as the minimum dead load likely to be in place during a design wind event.

1609.4 Wind and Seismic Detailing. Lateral-force-resisting systems shall meet seismic detailing requirements and limitations prescribed in 780 CMR, even when wind code prescribed load effects are greater than seismic load effects.

1609.5 Enclosure Classifications. Replace ASCE 7, Section 6.5.9.3 with 780 CMR 1609.5.1.

1609.5.1 Protection of Openings. In wind-borne debris regions, glazing in the lower 60 feet (18 288 mm) in buildings shall be assumed to be openings unless such glazing is impact resistant or protected with an impact-resistant covering meeting the requirements of an approved impact-resisting standard or ASTM E 1996 and of ASTM E 1886 referenced 780 CMR as follows:

1. Glazed openings located within 30 feet (9144 mm) of grade shall meet the requirements of the Large Missile Test of ASTM E 1996.
2. Glazed openings located more than 30 feet (9144 mm) above grade shall meet the provisions of the Small Missile Test of ASTM E 1996.

Exception. Wood structural panels with a minimum thickness of $^7/_{16}$ inch (11.1 mm) and maximum panel span of eight feet (2438 mm) shall be permitted for opening protection in one- and two-story buildings. Panels shall be precut to cover the glazed openings with attachment hardware provided. Attachments shall be designed to resist the components and cladding loads determined in accordance with the provisions of 780 CMR 1609.6.5. Attachment in accordance with Table 1609.5.1 is permitted for buildings with a mean roof height of 33 feet (10 058 mm) or less where wind speeds (three-second gust) do not exceed 130 miles per hour.

TABLE 1609.5.1 WINDBORN DEBRIS PROTECTION FASTENING SCHEDULE FOR WOOD STRUCTURAL PANELS[a, b, c]

FASTENER TYPE	FASTENER SPACING (inches)			
	Panel span ≤ 2 feet	2 feet ≤ Panel span ≤ 4 feet	4 feet < Panel span ≤ 6 feet	6 feet < Panel span ≤ 8 feet
2½ # 6 Wood Screws	16	16	12	9
2½ # 6 Wood Screws	16	16	16	12

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound = 0.454 kg, 1 mile per hour = 0.44 m/s.

a. Table 1609.5.1 is based on a maximum wind speed (three-second gust) of 130 mph and mean roof height of 33 feet or less.

b. Fasteners shall be installed at opposing ends of the wood structural panel.

c. Where screws are attached to masonry or masonry/stucco, they shall be attached utilizing vibration-resistant anchors having a minimum withdrawal capacity of 490 pounds.

1609.6 Rigid Tile Roof Coverings. Rigid tile roof coverings that are air-permeable are permitted to be designed in accordance with 780 CMR 1609.6.1

1609.6.1 Wind loads on air permeable rigid tile roof coverings may be determined in accordance with the following equation:

EQUATION 16-36

$$M_a = q_h C_L b L L_a [1.0 - G c_p]$$

where:

b = Exposed width feet (m) of the roof tile.

C_L = Lift coefficient. The lift coefficient for concrete and clay tile shall be 0.2 or shall be determined by test in accordance with 780 CMR 1715.2.

G_{cp} = Roof pressure coefficient for each applicable roof zone determined from ASCE 7, Section 6. Roof coefficients shall not be adjusted for internal pressure.

L = Length feet (m) of the roof tile.

L_a = Moment arm feet (m) from the axis of rotation to the point of uplift on the roof tile. The point of uplift shall be taken at 0.76L from the head of the tile and the middle of the exposed width. For roof tiles with nails or screws (with or without a tail clip), the axis of rotation shall be taken as the head of the tile for direct deck application or as the top edge of the batten for battened applications. For roof tiles fastened only by a nail or screw along the side of the tile, the axis of rotation shall be determined by testing. For roof tiles installed with battens and fastened only by a clip near the tail of the tile, the moment arm shall be determined about the top edge of the batten with consideration given for the point of rotation of the tiles based on straight bond or broken bond and the tile profile.

M_a = Aerodynamic uplift moment feet-pounds (kN-m) acting to raise the tail of the tile.

q_h = Wind velocity pressure psf (kN/m^2) determined from ASCE 7, Section.

Concrete and clay roof tiles complying with the following limitations shall be designed to withstand the aerodynamic uplift moment as determined by 780 CMR 1609.6.

1. The roof tiles shall be either loose laid on battens, mechanically fastened, mortar set or adhesive set.
2. The roof tiles shall be installed on solid sheathing which has been designed as components and cladding.
3. An underlayment shall be installed in accordance with 780 CMR 15.00.
4. The tile shall be single lapped interlocking with a minimum head lap of not less than two inches (51 mm).
5. The length of the tile shall be between 1.0 and 1.75 feet (305 mm and 533 mm).
6. The exposed width of the tile shall be between 0.67 and 1.25 feet (204 mm and 381 mm).
7. The maximum thickness of the tail of the tile shall not exceed 1.3 inches (33 mm).
8. Roof tiles using mortar set or adhesive set systems shall have at least ⅔ of the tile's area free of mortar or adhesive contact.

780 CMR 1610.0 LATERAL SOIL AND HYDROSTATIC LOADS

780 CMR 1610.0 is unique to Massachusetts

1610.1 General. Basement, foundation, and retaining walls shall be designed to resist lateral loads due to soil and water pressure. Lateral soil pressure on said walls shall be determined in accordance with the principles of soil mechanics and as provided in 780 CMR 18.00. Floors or similar elements below the water table shall be designed to resist the upward pressure of the water.

> **Exception.** Uninhabitable spaces with concrete floors on the ground with an under-slab drainage system, including sump pits and sump pumps, designed to keep the water level a minimum of one foot below the bottom of the floor slab need not be designed to resist water pressure.

780 CMR 1611.0 RAIN LOADS

1611.1 Design Rain Loads. Each portion of a roof shall be designed to sustain the load of rainwater that will accumulate on it if the primary drainage system for that portion is blocked plus the uniform load caused by water that rises above the inlet of the secondary drainage system at its design flow.

EQUATION 16-37

$$R = 5.2\ (d_s + d_h)$$

For SI: $R = 0.0098\ (d_s + d_h)$

where:

d_h = Additional depth of water on the undeflected roof above the inlet of secondary drainage system at its design flow (i.e., the hydraulic head), in inches (mm).

d_s = Depth of water on the undeflected roof up to the inlet of secondary drainage system when the primary drainage system is blocked (i.e., the static head), in inches (mm).

R = Rain load on the undeflected roof, in pounds per square foot (kN/m^2). When the phrase "undeflected roof" is used, deflections from loads (including dead loads) shall not be considered when determining the amount of rain on the roof.

1611.2 Ponding Instability. Ponding refers to the retention of water due solely to the deflection of relatively flat roofs. Roofs with a slope less than one-fourth unit vertical in 12 units horizontal (2% slope) shall be investigated by structural analysis to ensure that they possess adequate stiffness to preclude progressive deflection (i.e., instability) as rain falls on them or meltwater is created from snow on them. The larger of snow load or rain load shall be used in this analysis. The primary drainage system within an area subjected to ponding shall be considered to be blocked in this analysis.

1611.3 Controlled Drainage. Roofs equipped with hardware to control the rate of drainage shall be equipped with a secondary drainage system at a higher elevation that limits accumulation of water on the roof above that elevation. Such roofs shall be designed to sustain the load of rainwater that will accumulate on them to the elevation of the secondary drainage system plus the uniform load caused by water that rises above the inlet of the secondary drainage system at its design flow determined from 780 CMR 1611.1. Such roofs shall also be checked for ponding instability in accordance with 780 CMR 1611.2.

780 CMR 1612.0 FLOOD LOADS

780 CMR 1612.0 is unique to Massachusetts

1612.1 General. Flood loads shall be determined in accordance with ASCE 7, Section 5.3. Design and construction in flood zones shall be in accordance with ASCE 24 and 780 CMR 120.G and the more stringent design and construction requirements of ASCE 24 or 780 CMR 120.G , as applicable ("right to construct and structure allowed/required elevations shall be governed by the last sentence of 780 CMR 1612.1), shall be expressly identified at the building permit application stage and the more stringent requirements of either reference shall govern, except that flood loads shall be in accordance with the issue of ASCE 7 cited in 780 CMR 35.00 and "right-to construct" and structure-allowed elevations shall be governed by 780 CMR 120.G, M.G.L. c. 131, § 40 and any bylaws or ordinances that have legal standing in a community.

780 CMR 1613.0 EARTHQUAKE LOADS – PURPOSE

780 CMR 1613.0 through 1615.0 present criteria for the design and construction of buildings and nonbuilding structures subject to earthquake ground motion. The specified earthquake loads rely on post-elastic energy dissipation in the structure, and because of this fact, the provisions for design, detailing and construction shall be satisfied even for structures and members for which load combinations containing earthquake load produce lesser effects than other load combinations.

The purposes of 780 CMR 1613.0 through 1615.0 are to minimize the hazard to life of occupants of all buildings and nonbuilding structures, to increase the expected performance of high occupancy assembly and education buildings as compared to ordinary buildings, and to improve the capability of essential facilities to function during and after an earthquake. Because of the complexity of and the great number of variables involved in seismic design (*e.g.* variability in ground motion, soil types, dynamic characteristics of the structure, material strength properties and construction practices), 780 CMR 1613.0 through 1615.0 present only minimum criteria in general terms. These minimum criteria are considered to be prudent and economically justified for the protection of life safety in buildings subject to earthquakes and for improved capability of essential facilities to function immediately following an earthquake.

Absolute safety and prevention of damage, even in an earthquake event with a reasonable probability of occurrence, cannot be achieved economically for most buildings. The "design earthquake" ground motion levels specified in 780 CMR may result in both structural and non-structural damage. For most buildings designed and constructed according to 780 CMR 1613.0 through 1615.0, it is expected that structural damage from a major earthquake may be repairable but the repair may not be economically feasible. For ground motions larger than the design levels, the intent of 780 CMR 1613.0 through 1615.0 is that there will be a low likelihood of building collapse.

780 CMR 1614.0 EARTHQUAKE LOADS – GENERAL

1614.1 Scope. Every building and portion thereof, and certain nonbuilding structures as provided 780 CMR 1614.0 shall as a minimum be designed and constructed to resist the effects of earthquake motions and assigned a seismic design category as set forth in 780 CMR 1614.0

Exceptions:

1. Detached one- and two-family dwellings are exempt from the requirements of these provisions.
2. Agricultural storage buildings that are intended only for incidental human occupancy are exempt from the requirements of these provisions.
3. Additions to existing buildings. An addition that is attached to an existing building shall be designed and constructed in accordance with the requirements of 780 CMR 34.00. Structurally separate additions shall be designed and constructed in accordance with 780 CMR 16.00.
4. Change of occupancy: Where a change of occupancy occurs in an existing building, the building shall conform to the provisions of 780 CMR 34.00.
5. Alterations. Where alterations are made to an existing building, the building shall conform to the provisions of 780 CMR 34.00.
6. Special structures including, but not limited to, vehicular bridges, transmission towers, hydraulic structures, and nuclear power generating facilities shall be designed to resist earthquake loads, but require special consideration of their response characteristics and environment that is beyond the scope of 780 CMR 1614.0.

Structures shall be designed in accordance with ASCE 7. Only the following sections, as modified in 780 CMR 1614.0, shall apply: 9.1.2.4, 9.1.2.5, 9.1.3, 9.1.4, 9.2 through 9.6, 9.13, and 9.14. Within the above-noted sections, all references to Sections 9.7 through 9.12 shall be revised as follows:

ASCE 7	MASS STATE BUILDING CODE
9.7 Foundation Design Requirements	780 CMR 18.00 Soils and Foundations
9.8 Steel	780 CMR 22.00 Steel
9.9 Structural Concrete	780 CMR 19.00 Concrete
9.10 Composite Structure	(Not Applicable)
9.11 Masonry	780 CMR 21.00 Masonry
9.12 Wood	780 CMR 23.00 Wood

Appendices A.9 and B.0 of ASCE 7 are not applicable.

1614.2 Additions to Existing Buildings. See provisions of 780 CMR 34.00, except that 780 CMR 16.00 applies to structurally separate additions.

1614.3 Quality Assurance. A Quality Assurance Plan shall be provided where required by 780 CMR 17.00.

780 CMR 1615.0 EARTHQUAKE LOADS – MODIFICATIONS TO APPLICABLE PROVISIONS OF ASCE 7

(Note that the following subsections, commencing with the prefix number "9" are referring to applicable sections of ASCE 7).

1615.1 Changes to Applicable ASCE 7 Sections. The provisions of ASCE 7, Sections 9.1.2.4, 9.1.2.5, 9.1.3, 9.1.4, 9.2 through 9.6, 9.13 and 9.14 and all associated sub-sections shall apply except for certain paragraphs of those sections and sub-sections which have been modified or added as provided below:

9.1.2.4.1 New Buildings. New buildings and structures shall be designed and constructed in accordance with the quality assurance requirements of 780 CMR 17.00. The analysis and design of structural systems and components, including foundations, frames, walls, floors and roofs shall be in accordance with the applicable requirements of Section 9.5. The additional foundation requirements of 780 CMR 18.00 shall be followed. Materials used in construction and components made of these materials shall be designed and constructed to meet the requirements of 780 CMR 19.00 through 23.00. Architectural, electrical and mechanical systems and components, including tenant improvements, shall be designed in accordance with Section 9.6.

9.2.1 Definitions. The definitions presented in this Section provide the meaning of the terms used in these provisions. Definitions of terms that have a specific meaning relative to the use of concrete, masonry, steel or wood are presented in the Chapter devoted to the material (780 CMR 19.00, 21.00, 22.00 and 23.00). Disregard ASCE 7 references to non-applicable Sections and Appendix A9. (Note: *See* ASCE 7, Section 9.2.1 for definitions.)

9.2.2 Symbols. The unit dimensions used with the items covered by the symbols shall be consistent throughout except where specifically noted. The symbols and definitions presented in this Section apply to these provisions as indicated, except that references to A9.8 apply to 780 CMR 22.00 and references to A9.9 apply to 780 CMR 19.00. (Note: *See* ASCE 7, Section 9.2.2 for symbols.)

SECTION 9.4 – Site Ground Motion

9.4.1 Procedures for Determining Maximum Considered Earthquake and Design Earthquake Ground Motion Accelerations and Response Spectra. Ground motion accelerations, represented by response spectra and coefficients derived from these spectra, shall be determined in accordance with the general procedure of Section 9.4.1.2 or the site-specific procedure of Section 9.4.1.3. The general procedure in which spectral response acceleration parameters for the maximum considered earthquake ground motions are derived using Table 1604.10 of the Massachusetts State Building Code, modified by site coefficients to include local site effects and scaled to design values, are permitted to be used for any structure except as specifically indicated in these provisions. The site-specific procedure also is permitted to be used for any structure and shall be used where specifically required by these provisions.

9.4.1.1 Maximum Considered Earthquake Ground Motions. The maximum considered earthquake ground motions shall be as represented by the spectral response acceleration at short periods (S_s) and at 1-sec (S_1) obtained from Table 1604.10 of the Massachusetts State Building Code and adjusted for Site Class effects using the site coefficients of Section 9.4.1.2.4. When a site-specific procedure is used, maximum considered earthquake ground motion shall be determined in accordance with Section 9.4.1.3.

9.4.1.2 General Procedure for Determining Maximum Considered Earthquake and Design Spectral Response Accelerations. The maximum considered earthquake spectral response acceleration at short periods (S_s) and at 1-sec (S_1) shall be determined from Table 1604.10 of the Massachusetts State Building Code based on the municipality in which the site is located. Where a site is located in more than one municipality, the higher spectral response acceleration values shall be used.

For buildings and structures included in the scope of this Standard as specified in Section 9.1.2.1, the Site Class shall be determined in accordance with Section 9.4.1.2.1. The maximum considered earthquake spectral response accelerations adjusted for Site Class effects, S_{MS} andS_{M1}, shall be determined in accordance with Section 9.4.1.2.4 and the design spectral response accelerations, S_{DS} andS_{D1}, shall be determined in accordance with Section 9.4.1.2.5. The general response spectrum, when required by these provisions, shall be determined in accordance with Section 9.4.1.2.6.

9.4.1.2.1 Site Class Definitions. The site shall be classified as one of the following classes:

A = Hard rock with measured shear wave velocity, $\overline{v}_s > 5000$ft/s (1500 m/s)

B = Rock with 2500 ft/s $< \overline{v}_s \leq 5000$ ft/s (760 m/s $< \overline{v}_s \leq$ 1500 m/s)

C = Very dense soil and soft rock with 1200 ft/s $\leq \overline{v}_s \leq$ 2500 ft/s (370 m/s $\leq \overline{v}_s \leq$ 760 m/s) or $\overline{N}$ or $\overline{N}_{ch} > 50$ or $\overline{s}_u \geq$ 2000 psf (100 kPa)

D = Stiff soil with 600 ft/s $\leq \overline{v}_s \leq$ 1200 ft/s (180 m/s $\leq \overline{v}_s \leq$ 370 m/s) or with $15 \leq \overline{N}$ or $\overline{N}_{ch} \leq 50$ or 1000 psf $\leq \overline{s}_u \leq$ 2000 psf (50 kPa $\leq \overline{s}_u \leq$ 100 kPa)

E = A soil profile with $\overline{v}_s <$ 600 ft/s (180 m/s) or any profile with more than 10 ft (3 m) of soft clay. Soft clay is defined as soil with $PI > 20$, $w \geq 40\%$, and $s_u <$ 500 psf (25 kPa)

F = Soils requiring site-specific evaluations:

1. Soils vulnerable to potential failure or collapse under seismic loading such as liquefiable soils, quick and highly sensitive clays, collapsible weakly cemented soils. Potential for liquefaction shall be evaluated in accordance with 780 CMR 1804.6: *Liquefaction*.

Exception. None.

2. Peats and/or highly organic clays ($H >$ 10 ft [3 m] of peat and/or highly organic clay where H = thickness of soil).
3. Very high plasticity clays (H > 25 ft [7.6 m] with $PI > 75$).
4. Very thick soft/medium stiff clays (H>120 ft [37 m].

Exception. None.

The following standards are referenced for determining the seismic coefficients:

(a) ASTM. "Test Method for Penetration Test and Split-Barrel Sampling of Soils." *ASTM D1586-84*, 1984.
(b) ASTM. "Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils." *ASTM D4318-93*, 1993.
(c) ASTM. "Test Method for Laboratory Determination of Water (Moisture) Content of Soil and Rock." *ASTM D2216-92*, 1992.
(d) ASTM. "Test Method for Unconfined Compressive Strength of Cohesive Soil." *ASTM D2166-1991*, 1991.
(e) ASTM. "Test Method for Unconsolidated, Undrained Compressive Strength of Cohesive Soils in Triaxial Compression." *ASTM D2850-87*, 1987.

9.4.1.2.2 Steps for Classifying a Site. The Site Class of a site shall be determined using the following steps:

Step 1: Check for the four categories of Site Class F requiring site-specific evaluation. If the site corresponds to any of these categories, classify the site as Site Class F and conduct a site-specific evaluation.

Exception. Refer to exception in Note a in Table 9.4.1.2.4a and in Table 9.4.1.2.4b.

Step 2: Check for the existence of a total thickness of soft clay > 10 ft (3 m) where a soft clay layer is defined by $s_u < 500$ psf (25 kPa), $w > 40\%$, and $PI > 20$. If this criterion is satisfied, classify the site as Site Class E.

Step 3: Categorize the site using one of the following three methods with $\overline{v}_s$, $\overline{N}$, and $\overline{s}_u$ computed in all cases as specified by the definitions in Section 9.4.1.2.3.

a. **The $\overline{v}_s$ Method**: Determine $\overline{v}_s$ for the top 100 ft (30m) of soil. Compare the value of $\overline{v}_s$ with those given in Section 9.4.1.2 and Table 9.4.1.2 and assign the corresponding Site Class.

$\overline{v}_s$ for rock, Site Class B, shall be measured on-site or estimated by a geotechnical engineer or engineering geologist/seismologist for competent rock with moderate fracturing and weathering. $\overline{v}_s$ for softer and more highly fractured and weathered rock shall be measured on-site or shall be classified as Site Class C. The Classification of hard rock, Site Class A, shall be supported by on-site measurements of $\overline{v}_s$ or on profiles of the same rock type in the same formation with an equal or greater degree of weathering and fracturing. Where hard rock conditions are known to be continuous to a depth of at least 100 ft (30 m), surficial measurements of v_s are not prohibited from being extrapolated to assess $\overline{v}_s$.

b. **The $\overline{N}$ Method**: Determine $\overline{N}$ for the top 100 ft (30 m) of soil. Compare the value of $\overline{N}$ with those given in Section 9.4.1.2 and Table 9.4.1.2 and assign the corresponding Site Class.

c. **The $\overline{s}_u$ Method**: For cohesive soil layers, determine $\overline{s}_u$ for the top 100 ft (30 m) of soil. For cohesionless soil layers, determine $\overline{N}_{ch}$ for the top 100 ft (30 m) of soil. Cohesionless soil is defined by a $PI < 20$ where cohesive soil is defined by a $PI > 20$. Compare the values of $\overline{s}_u$ and $\overline{N}_{ch}$ with those given in Section 9.4.1.2 and Table 9.4.1.2 and assign the corresponding Site Class. When the $\overline{N}_{ch}$ and $\overline{s}_u$ criteria differ, assign the category with the softer soil (Site Class E soil is softer than D).

d. When soil properties are not known in sufficient detail to determine the site class, Site Class D shall be used unless the building official determines that soils of Site Class E or Site Class F are likely to be present at the site.

e. The rock categories, Site Classes A and B, shall not be assigned to a site if there is more than ten feet (3 m) of soil between the rock surface and the bottom of the spread footing or mat foundation.

9.4.1.2.3 Definitions of Site Class Parameters. The definitions presented below apply to the upper 100 ft (30 m) of the site profile. Profiles containing distinctly different soil and/or rock layers shall be subdivided into those layers designated by a number that ranges from 1 to *n* at the bottom where there are a total of *n* distinct layers in the upper 100 ft (30 m). Where some of the *n* layers are cohesive and others are not, *k* is the number of cohesive layers and *m* is the number of cohesionless layers. The symbol *i* refers to any one of the layers between 1 and *n*.

v_{si} is the shear wave velocity in ft/s (m/s).

d_i is the thickness of any layer between 0 and 100 ft (30 m).

$\overline{v}_s$ is **EQUATION 9.4.1.2-1**

$$v_s = \frac{\sum_{i=1}^{n} d_i}{\sum_{i=1}^{n} \frac{di}{v_{si}}}$$

whereby $\sum_{i=1}^{n} d_i$ is equal to 100 ft (30 m)

N_I is the standard penetration resistance, ASTM D156-84 not to exceed 100 blows/ft as directly measured on the field without corrections. When refusal is met for a rock layer, N_i shall be taken as 100 blows/foot.

$\overline{N}$ is **EQUATION 9.4.1.2-2**

$$\overline{N} = \frac{\sum_{i=1}^{n} d_i}{\sum_{i=1}^{n} \frac{d_i}{N_i}}$$

where N_i and d_i in Equation 9.4.1.2-2 are for cohesionless soil, cohesive soil, and rock layers.

$\overline{N}_{ch}$ is **EQUATION 9.4.1.2-3**

$$\overline{N}_{ch} = \frac{d_s}{\sum_{i=1}^{m} \frac{d_i}{N_i}}$$

whereby $=\sum_{i=1}^{m} d_i = d_s$. (Use only d_i and N_i for cohesionless soils.)

d_s is the total thickness of cohesionless soil layers in the top 100 ft (30 m)

$\overline{s}_u$ is the undrained shear strength in psf (kPa), not to exceed 5000 psf (240 kPa), ASTM D2166-91 or D2850-87.

$\overline{s}_u$ is **EQUATION 9.4.1.2-4**

$$\overline{s}_u = \frac{d_c}{\sum_{i=1}^{k} \frac{di}{s_{ui}}}$$

whereby $\sum_{i=1}^{k} d_i = d_c$.

d_c is the total thickness (100 - d_s) of cohesive soil layers in the top 100 ft (30 m)

Pl is the plasticity index, ASTM D4318-93

w is the moisture content in percent, ASTM D2216-92

Figures 9.4.1.1(a) *through* 9.4.1.1(j)

__These figures are not included.__ Refer to Table 1604.10 of the Massachusetts State Building Code for all references to these figures.

9.4.1.2.4 Site Coefficients and Adjusted Maximum Considered Earthquake Spectral Response Acceleration Parameters. The maximum considered earthquake spectral response acceleration for short periods (S_{MS}) and at 1-sec (S_{M1}), adjusted for site class effects, shall be determined by Equations 9.4.1.2.4-1 and 9.4.1.2.4-2, respectively.

EQUATION 9.4.1.2.4-1

$$S_{MI}= F_aS_s$$

EQUATION 9.4.1.2.4-2

$$S_{m1} = F_vS_1$$

where

S_1 = the tabulated maximum considered earthquake spectral response acceleration at a period of 1-sec as determined in accordance with Section 9.4.1

S_s = the tabulated maximum considered earthquake spectral response acceleration at short periods as determined in accordance with Section 9.4.1

where site coefficients F_a and F_v are defined in Tables 9.4.1.2.4a and b, respectively.

TABLE 9.4.1.2.4a VALUES OF F_a AS A FUNCTION OF SITE CLASS AND SHORT PERIOD MAXIMUM CONSIDERED EARTHQUAKE SPECTRAL ACCELERATION

Site Class	*Tabulated Maximum Considered Earthquake Spectral Response Acceleration at Short Periods*					
	$S_S \le 0.26$	$0.27 \le S_S \le 0.29$	$0.30 \le S_S \le 0.32$	$0.33 \le S_S \le 0.35$	$0.36 \le S_S \le 0.38$	$S_S \ge 0.39$
A	0.8	0.8	0.8	0.8	0.8	0.8
B	1.0	1.0	1.0	1.0	1.0	1.0
C	1.2	1.2	1.2	1.2	1.2	1.2
D	1.6	1.6	1.55	1.5	1.5	1.5
E	2.5	2.4	2.3	2.2	2.1	2.0
F	Note a	Note a	Note a	Note a	Note a	Note a

Note a: Site-specific geotechnical investigation and dynamic site response analyses shall be performed except that for structures with periods of vibration equal to or less than 0.5-seconds, values of F_a for liquefiable soils may be assumed equal to the values for the site class determined without regard to liquefaction in Step 3 of 9.4.1.2.2.

TABLE 9.4.1.2.4b VALUES OF F_v AS A FUNCTION OF SITE CLASS

Site Class	*Tabulated Maximum Considered Earthquake Spectral Response Acceleration at 1-Second Periods*
	$S_1 \leq 0.1$
A	0.8
B	1.0
C	1.7
D	2.4
E	3.5
F	Note a

Note a: Site-specific geotechnical investigation and dynamic site response analyses shall be performed except that for structures with periods of vibration equal to or less than 0.5-seconds, values of F_v for liquefiable soils may be assumed equal to the values for the site class determined without regard to liquefaction in Step 3 of 9.4.1.2.2.

9.4.2 Seismic Design Category. Structures shall be assigned a Seismic Design Category in accordance with Section 9.4.2.1. Seismic Design Categories A, E, and F are not applicable in Massachusetts.

9.4.2.1 Determination of Seismic Design Category. All structures shall be assigned to a Seismic Design Category based on their Seismic Use Group and the design spectral response acceleration coefficients, S_{DS} and S_{D1}, determined in accordance with Section 9.4.1.2.5. Each building and structure shall be assigned to the most severe Seismic Design Category in accordance with Table 9.4.2.la or 9.4.2.lb, irrespective of the fundamental period of vibration of the structure, *T*.

Exception. The seismic Design Category is permitted to be determined from Table 9.4.2.1a alone when all of the following apply:

1. In each of the two orthogonal directions, the approximate fundamental period of the structure, T_a, determined in accordance with Section 9.5.5.3.2, is less than $0.8T_s$, where T_s is determined in accordance with Section 9.4.1.2.6 and
2. In each of the two orthogonal directions, the fundamental period of the structure used to calculate the story drift is less than T_s and
3. Equation 9.5.5.2.1-1 is used to determine the seismic response coefficient, C_s and
4. The diaphragms are rigid or for diaphragms that are flexible, the distance between vertical elements of the seismic force-resisting system does not exceed 40 feet.

TABLE 9.4.2.1a SEISMIC DESIGN CATEGORY BASED UPON SHORT PERIOD RESPONSE ACCELERATIONS

Value of S_{DS}	**Seismic Use Group**		
	I	II	III
$S_{DS} < 0.33g$	B	B	C
$0.33g \leq S_{DS} < 0.50g$	C	C	D
$0.50g \leq S_{DS}$	D	D	D

TABLE 9.4.2.1b SEISMIC DESIGN CATEGORY BASED UPON 1-SECOND PERIOD RESPONSE ACCELERATIONS

Value of S_{D1}	**Seismic Use Group**		
	I	II	III
$S_{D1} < 0.133g$	B	B	C
$0.133g \leq S_{D1} < 0.20g$	C	C	D
$0.20g \leq S_{D1}$	D	D	D

9.4.3 Quality Assurance. *See* 780 CMR 1614.3.

9.5 STRUCTURAL DESIGN CRITERIA, ANALYSIS, AND PROCEDURES

9.5.2.1 Design Basis. The seismic analysis and design procedures to be used in the design of structures and their components shall be as prescribed in this Section. The structure shall include complete lateral and vertical force-resisting systems capable of providing adequate strength, stiffness, and energy dissipation capacity to withstand the design ground motions within the prescribed limits of deformation and strength demand. The design ground motions shall be assumed to occur along any horizontal direction of a structure. The adequacy of the structural systems shall be demonstrated through the construction of a mathematical model and evaluation of this model for the effects of design ground motions. The design seismic forces, and their distribution over the height of the structure, shall be established in accordance with one of the applicable procedures indicated in Section 9.5.2.5 and the corresponding internal forces and deformations in the members of the structure shall be determined. An approved alternative procedure shall not be used to establish the seismic forces and their distribution unless the corresponding internal forces and deformations in the members are determined using a model consistent with the procedure adopted.

Individual members shall be provided with adequate strength to resist the shears, axial forces, and moments determined in accordance with these provisions, and connections shall develop the strength of the connected members or the forces indicated above. The deformation of the structure shall not exceed the prescribed limits when the structure is subjected to the design seismic forces.

A continuous load path, or paths, with adequate strength and stiffness shall be provided to transfer all forces from the point of application to the final point of resistance. The foundation shall be designed to resist the forces developed and accommodate the movements imparted to the structure by the design ground motions. The dynamic nature of the forces, the expected ground motion, and the design basis for strength and energy dissipation capacity of the structure shall be included in the determination of the foundation design criteria.

Allowable Stress Design is permitted to be used to evaluate sliding, overturning, and soil bearing at the soil-structure interface regardless of the design approach used in the design of the structure.

The foundation elements shall be designed to resist the forces developed and shall accommodate the movements imparted to the building by the design ground motions. The foundation design criteria shall account for the dynamic nature of the seismic forces, the design ground motions, and the design basis for strength and ductility of the structure.

Consideration shall be given to the manner in which the earthquake lateral force, computed in accordance with Section 9.5.2.5, will be transmitted from the soil or rock to the structure. Transmission of the lateral force will occur through one or more of the following foundation elements:

1. Lateral soil pressure against foundation walls, footings, grade beams and/or pile caps;
2. Lateral soil pressure against piles, piers or caissons;
3. Side or bottom friction on walls, footings or mats; or
4. Batter piles.

Bottom friction under pile caps shall be assumed to be ineffective in transmitting horizontal forces.

The horizontal force shall be distributed among the various elements of the foundation in proportion to their estimated rigidities. Any element which will participate in the transfer of horizontal forces from the soil or rock to the structure shall be designed to resist forces in such a way that its ability to sustain static load will not be impaired.

TABLE 9.5.2.2 DESIGN COEFFICIENTS AND FACTORS FOR BASIC SEISMIC-FORCE-RESISTING SYSTEMS

BASIC SEISMIC-FORCE-RESISTING SYSTEM	DETAILING REFERENCE SECTION	RESPONSE MODIFICATION COEFFICIENT, R[a]	SYSTEM OVER-STRENGTH FACTOR, $-\Omega_0$[c]	DEFLECTION AMPLIFICATION FACTOR, C_d[b]	STRUCTURAL SYSTEM LIMITATIONS AND BUILDING HEIGHT (ft) LIMITATIONS BY SEISMIC DESIGN CATEGORY[c]		
					B	C	D[d]
1. Bearing Wall Systems							
A. Ordinary steel braced frames in light-gage construction	2211	4	2	3½	NL	NL	65
B. Ordinary steel concentrically braced frames	NP	NP	NP	NP A	NP	NP	NP
C. Special reinforced concrete shear walls	1910.2.4	5	2½	5	NL	NL	160
D. Ordinary reinforced concrete shear walls	1910.2.3	4	2½	4	NL	NL	NP
E. Detailed plain concrete shear walls	NP	NP	NP	NP	NP	NP	NP
F. Ordinary plain concrete shear walls	NP	NP	NP	NP	NP	NP	NP

BASIC SEISMIC-FORCE-RESISTING SYSTEM	DETAILING REFERENCE SECTION	RESPONSE MODIFICATION COEFFICIENT, R[a]	SYSTEM OVER-STRENGTH FACTOR, $-\Omega_o$[g]	DEFLECTION AMPLIFICATION FACTOR, C_d[b]	STRUCTURAL SYSTEM LIMITATIONS AND BUILDING HEIGHT (ft) LIMITATIONS BY SEISMIC DESIGN CATEGORY[c]		
					B	C	D[d]
G. Special reinforced masonry shear walls	2106	5	2½	3½	NL	NL	160
H. Intermediate reinforced masonry shear walls	2106	3½	2½	2¼	NL	NL	NP
I. Ordinary reinforced masonry shear walls	NP	NP	NP	NP	NP	NP	NP
J. Detailed plain masonry shear walls	NP	NP	NP	NP	NP	NP	NP
K. Ordinary plain masonry shear walls	NP	NP	NP	NP	NP	NP	NP
L. Light-framed walls sheathed with wood structural panels rated for shear resistance or steel sheets	2211/2305/ 2306	6	3	4	NL	NL	65
M. Light-framed walls with shear panels of all other materials	2211/2305 /2306	2	2½	2	*35*	*35*	NP
N. Light-framed wall systems using flat strap bracing	2211/2305/ 2306	4	2	3½	NL	NL	65
O. Ordinary plain prestressed masonry shear walls	NP	NP	NP	NP	NP	NP	NP
P. Intermediate prestressed masonry shear walls	2106	2½	2½	2½	NL	NP	NP
Q. Special prestressed masonry shear walls	NP	NP	NP	NP	NP	NP	NP
2. Building Frame Systems							
A. Steel eccentrically braced frames, moment-resisting connections at columns away from links	(15)[j]	8	2	4	NL	NL	160
B. Steel eccentrically braced frames, non-moment-resisting connections at columns away from links	(15)[j]	7	2	4	NL	NL	160
C. Special steel concentrically braced frames	(13)[j]	6	2	5	NL	NL	160
D. Ordinary steel concentrically braced frames	(14)[j]	*3¼*	2	*3¼*	NL	NL	35[n]
E. Special reinforced concrete shear walls	1910.2.4	6	2½	5	NL	NL	160
F. Ordinary reinforced concrete shear walls	1910.2.3	5	2½	4½	NL	NL	NP
G. Detailed plain concrete shear walls	NP	NP	NP	NP	NP	NP	NP
H. Ordinary plain concrete shear walls	NP	NP	NP	NP	NP	NP	NP
I. Composite eccentrically braced frames	(14)[k]	8	2	4	NL	NL	160
J. Composite concentrically braced frames	(13)[k]	5	2	4½	NL	NL	160
K. Ordinary composite braced frames	(12)[k]	3	2	3	NL	NL	NP

BASIC SEISMIC-FORCE-RESISTING SYSTEM	DETAILING REFERENCE SECTION	RESPONSE MODIFICATION COEFFICIENT, R^a	SYSTEM OVER-STRENGTH FACTOR$_g$, $-\Omega_o^c$	DEFLECTION AMPLIFICATION FACTOR, C_d^b	STRUCTURAL SYSTEM LIMITATIONS AND BUILDING HEIGHT (ft) LIMITATIONS BY SEISMIC DESIGN CATEGORY[c]		
					B	C	D[d]
L. Composite steel plate shear walls	(17)[k]	6½	2½	5½	NL	NL	160
M. Special composite reinforced concrete shear walls with steel elements	(16)[k]	6	2½	5	NL	NL	160
N. Ordinary composite reinforced concrete shear walls with steel elements	(15)[k]	5	2½	4½	NL	NL	NP
O. Special reinforced masonry shear walls	2106	5½	2½	4	NL	NL	160
P. Intermediate reinforced masonry shear walls	2106	4	2½	4	NL	NL	NP
Q. Ordinary reinforced masonry shear walls	NP	NP	NP	NP	NP	NP	NP
R. Detailed plain masonry shear walls	NP	NP	NP	NP	NP	NP	NP
S. Ordinary plain masonry shear walls	NP	NP	NP	NP	NP	NP	NP
T. Light-framed walls sheathed with wood structural panels rated for shear resistance or steel sheets	2211/2305/ 2306	6½	2½	4¼	NL	NL	65
U. Light-framed walls with shear panels of all other materials	2211/2305/ 2306	2½	2½	2½	35	35	*NP*
V. Ordinary plain prestressed masonry shear walls	NP	NP	NP	NP	NP	NP	NP
W. Intermediate Prestressed masonry shear walls	2106	3	2½	2½	NL	NP	NP
X. Special prestressed masonry shear walls	NP	NP	NP	NP	NP	NP	NP
3. Moment-Resisting Frame Systems							
A. Special steel moment frames	(9)[j]	8	3	5½	NL	NL	NL
B. Special steel truss moment frames	(12)[j]	7	3	5½	NL	NL	160
C. Intermediate steel moment frames	(10)[j]	4½	3	4	NL	NL	35[h]
D. Ordinary steel moment frames	(11)[j]	3½	3	3	NL	NL	NP[h,i]
E. Special reinforced concrete moment frames	(21.1)[l]	8	3	5½	NL	NL	NL
F. Intermediate reinforced concrete moment frames	(21.1)[l]	5	3	4½	NL	NL	NP
G. Ordinary reinforced concrete moment frames	NP	NP	NP	NP	NP	NP	NP
H. Special composite moment frames	(9)[k]	8	3	5½	NL	NL	NL
I. Intermediate composite moment frames	(10)[k]	5	3	4½	NL	NL	NP
J. Composite partially restrained moment frames	(8)[k]	6	3	5½	160	160	100

BASIC SEISMIC-FORCE-RESISTING SYSTEM	DETAILING REFERENCE SECTION	RESPONSE MODIFICATION COEFFICIENT, R^{a}	SYSTEM OVER-STRENGTH FACTOR, $-\Omega_o^{g}$	DEFLECTION AMPLIFICATION FACTOR, C_d^{b}	STRUCTURAL SYSTEM LIMITATIONS AND BUILDING HEIGHT (ft) LIMITATIONS BY SEISMIC DESIGN CATEGORY^{c}		
					B	C	D^{d}
K. Ordinary composite moment frames	(11)^{k}	3	3	2½	NL	NP	NP
L. Special masonry moment frames	NP	NP	NP	NP	NP	NP	NP
4. Dual Systems with Special Moment Frames Capable of Resisting at Least 25% of Prescribed Seismic Forces							
A. Steel eccentrically braced frames, moment-resisting connections at columns away from links	(15)^{j}	8	2½	4	NL	NL	NL
B. Steel eccentrically braced frames, non-moment-resisting connections at columns away from links	(15)^{j}	7	2½	4	NL	NL	NL
C. Special steel concentrically braced frames	(13)^{j}	8	2½	6½	NL	NL	NL
D. Special reinforced concrete shear walls	1910.2.4	8	2½	6½	NL	NL	NL
E. Ordinary reinforced concrete shear walls	1910.2.3	7	2½	6	NL	NL	NP
F. Composite eccentrically braced frames	(14)^{k}	8	2½	4	NL	NL	NL
G. Composite concentrically braced frames	(13)^{k}	6	2½	5	NL	NL	NL
H. Composite steel plate shear walls	(17)^{k}	8	2½	6½	NL	NL	NL
I. Special composite reinforced concrete shear walls with steel elements	(16)^{k}	8	2½	6½	NL	NL	NL
J. Ordinary composite reinforced concrete shear walls with steel elements	(15)^{k}	7	2½	6	NL	NL	NP
K. Special reinforced masonry shear walls	2106	7	3	6½	NL	NL	NL
L. Intermediate reinforced masonry shear walls	2106	6	3	5	NL	NL	NP
M. Ordinary steel concentrically braced frames	NP	NP	NP	NP	NP	NP	NP
5. Dual Systems with Intermediate Moment Frames Capable of Resisting at Least 25% of Prescribed Seismic Forces^{m}							
A. Special steel concentrically braced frames^{f}	(13)^{j}	4½	2½	4½	NL	NL	35^{h}
B. Special reinforced concrete shear walls	1910.2.4	6	2½	5	NL	NL	160
C. Ordinary reinforced concrete shear walls	1910 2.3	5½	2½	4½	NL	NL	NP
D. Ordinary reinforced masonry shear walls	NP	NP	NP	NP	NP	NP	NP
E. Intermediate reinforced masonry shear walls	2106	5	3	4½	NL	NL	NP
F. Composite concentrically braced frames	(13)^{k}	5	2½	4½	NL	NL	160
G. Ordinary composite braced frames	(12)^{k}	4	2½	3	NL	NL	NP

BASIC SEISMIC-FORCE-RESISTING SYSTEM	DETAILING REFERENCE SECTION	RESPONSE MODIFICATION COEFFICIENT, R[a]	SYSTEM OVER-STRENGTH FACTOR, $-\Omega_0^{g}$	DEFLECTION AMPLIFICATION FACTOR, C_d^b	STRUCTURAL SYSTEM LIMITATIONS AND BUILDING HEIGHT (ft) LIMITATIONS BY SEISMIC DESIGN CATEGORY[c]		
					B	C	D[d]
H. Ordinary composite reinforced concrete shear walls with steel elements	(15)[k]	5	3	4½	NL	NL	NP
I. Ordinary steel concentrically braced frames	NP	NP	NP	NP	NP	NP	NP
6. Shear Wall-Frame Interactive System with Ordinary Reinforced Concrete Moment Frames and Ordinary Reinforced Concete Shear Walls	NP	NP	NP	NP	NP	NP	NP
7. Inverted Pendulum Systems							
A. Cantilevered column systems		2½	2	2½	NL	NL	35
B. Special steel moment frames	(9)[j]	2½	2	2½	NL	NL	NL
C. Ordinary steel moment frames	(11)[j]	1¼	2	2½	NL	NL	NP
D. Special reinforced concrete moment frames	21.1[l]	2½	2	1¼	NL	NL	NL
8. Structural Steel Systems Not Specifically Detailed For Seismic Resistance	AISC--335 AISC--LRFD AISI AISC--HSS 2205 2.1 *See footnote p*	3	3	3	100	65	NP

For SI: 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kN/m^2.

a. Response modification coefficient, R, for use throughout the standard. Note R reduces forces to a strength level, not an allowable stress level.

b. Deflection amplification factor, Cd, for use in Sections 9.5.3.7.1 and 9.5.3.7.2.

c. NL = Not Limited and NP = Not Permitted. For metric units use 30 m for 100 ft and use 50 m for 160 ft. Heights are measured from the base of the structure as defined in Section 9.2.1.

d. See Section 9.5.2.2.4.1 for a description of building systems limited to buildings with a height of 240 ft (75 m) or less.

e. **Note deleted.**

f. Ordinary moment frame is permitted to be used in lieu of intermediate moment frames in Seismic Design Categories B and C.

g. The tabulated value of overstrength factor, Ω, may be reduced by subtracting 1/2 for structures with flexible diaphragms, but shall not be taken as less than 2.0 for any structure.

h. Steel ordinary moment frames and intermediate moment frames are permitted in single story buildings up to a height of 60 ft, when the moment joints of field connections are constructed of bolted end plates and the dead load of the roof does not exceed 15 psf. The dead weight of the portion of walls more than 35 feet above the base shall not exceed 15 psf.

i. Steel ordinary moment frames are permitted in buildings up to a height of 35 feet, where the dead load of the walls, floors and roof does not exceed 15 psf.

j. AISC 341 Seismic Part I or Part III, Section number.

k. AISC 341 Seismic Part II, Section number.

l. ACI 318, Section number.

m. Steel intermediate moment resisting frames as part of a dual system are not permitted in Seismic Design Category D.

n. Steel ordinary concentrically braced frames are permitted in penthouse structures and in single-story buildings up to a height of 60 feet when the dead load of the roof does not exceed 15 pounds per square foot.

o. **Note deleted.**

p. K-Braced Frames are not permitted. For V-Type and Inverted V-Type Bracing, the frames shall comply with AISC 341 Section 13.4a, as modified by this Code, except for clause (3).

9.5.2.6 Design and Detailing Requirements. The design and detailing of the components of the seismic force-resisting system shall comply with the requirements of this Section. Foundation design shall conform to the applicable requirements of 780 CMR 18.00. The materials and the systems composed of those materials shall conform to the requirements of 780 CMR 19.00 through 23.00 for the applicable category.

9.5.2.6.1.2 Anchorage of Concrete or Masonry Walls. Concrete and masonry walls shall be anchored to the roof and all floors and members that provide lateral support for the wall or which are supported by the wall. The anchorage shall provide a direct connection between the walls and the roof or floor construction. The connections shall be capable of resisting the horizontal forces specified in Section 9.5.2.6.1.1 but not less than a minimum strength level, horizontal force of 280 lbs/ linear ft (4.09 kN/m) of wall substituted for *E* in the load combinations of 780 CMR 1605.2.1. and 1605.3. Also see 780 CMR 1604.8.

9.5.2.6.2.5 Nonredundant Systems. The design of a structure shall consider the potentially adverse effect that the failure of a single member, connection, or component of the seismic force-resisting system will have on the stability of the structure; see 780 CMR 1604.11.

9.5.2.6.2.8 Design of Concrete or Masonry Walls and Their Anchorage for Out-of-plane Forces. Concrete or masonry walls and their anchorage shall be designed for a force normal to the surface equal to 40% of the short period spectral response acceleration, S_{DS}, times the occupancy importance factor, I, multiplied by the weight of wall, with a minimum force of 10 % of the weight of the wall. Walls shall be designed to resist bending between anchors where the anchor spacing exceeds four feet Interconnection of wall elements and connections to supporting framing systems shall have sufficient ductility, rotational capacity, or sufficient strength to resist shrinkage, thermal changes, and differential foundation settlement when combined with seismic forces.

9.5.2.6.2.8.1 Anchorage of Concrete or Masonry Walls. The anchorage of concrete or masonry walls to floors, roofs and other structural elements that provide lateral support to the wall or are supported by the wall shall provide a positive direct connection capable of resisting the greater of the following:

1. A force of 0.4 S_{DS} I W_c
2. A force of 400 S_{DS} I lbs/linear foot (5.84 S_{DS} *I kN/m*) of wall, except that a force of 800$S_{DS}IW_c$ lbs/linear foot of wall shall apply for anchorage to flexible diaphragms
3. 280 lbs/linear ft of wall

where I = the occupancy importance factor, per Section 9.1.4.and W_c = the weight of wall tributary to the anchor.

9.5.2.6.3.2 Design and Anchorage of Concrete or Masonry Walls. Diaphragms shall be provided with continuous ties or struts between diaphragm chords to distribute these anchorage forces into the diaphragms. Added chords may be used to form subdiaphragms to transmit the anchorage forces to the main continuous cross ties. The maximum length-to-width ratio of the structural subdiaphragm shall be 2½ to 1. Connections and anchorages capable of resisting the prescribed forces shall be provided between the diaphragm and the attached components. Connections shall extend into the diaphragm a sufficient distance to develop the force transferred into the diaphragm.

The strength design forces for steel elements of the wall anchorage system, other than anchor bolts and reinforcing steel, shall be 1.4 times the forces otherwise required by this Section.

In wood diaphragms, the continuous ties shall be in addition to the diaphragm sheathing. Anchorage shall not be accomplished by use of toe nails or nails subject to withdrawal nor shall wood ledgers of framing be used in cross-grain bending or cross-grain tension. The diaphragm sheathing shall not be considered effective as providing the ties or struts required by this Section.

In metal deck diaphragms, the metal deck shall not be used as the continuous ties required by this Section in the direction perpendicular to the deck span.

Diaphragm to wall anchorage using embedded straps shall be attached to, or hooked around, the reinforcing steel or otherwise terminated so as to effectively transfer forces to the reinforcing steel.

When elements of the wall anchorage system are loaded eccentrically or are not perpendicular to the wall, the system shall be designed to resist all components of the forces induced by the eccentricity.

When pilasters are present in the wall, the anchorage force at the pilasters shall be calculated considering the additional load transferred from the wall panels to the pilasters. However, the minimum anchorage force at a floor or roof shall not be reduced.

9.5.2.6.4.2 Plan or Vertical Irregularities. For structures having a plan structural irregularity of Type 1, 2, 3, or 4 in Table 9.5.2.3.2 or a vertical structural irregularity of Type 4 in Table 9.5.2.3.3, the design forces determined from Section 9.5.3.2 shall be increased 25% for connections of diaphragms to vertical elements and to collectors and for connections of collectors to the vertical elements. Collectors and their connections also shall be designed for these increased forces unless they are designed for the special seismic loads of Section 9.5.2.7.1, in accordance with Section 9.5.2.6.3.1.

9.5.2.7 Combination of Load Effects. The effects on the structure and its components due to seismic forces shall be combined with the effects of other loads in accordance with the combinations of load effects given in 780 CMR 1605.0. For use with those combinations, the earthquake-induced force effect shall include vertical and horizontal effects as given by Equation 9.5.2.7-1 or 9.5.2.7-2, as applicable. The vertical seismic effect term $0.2S_{DS}$ D need not be included where S_{DS} is equal to or less than 0.125 in Equations 9.5.2.7-1, 9.5.2.7-2, 9.5.2.7.1-1, and 9.5.2.7.1-2. The vertical seismic effect term $0.2S_{DS}$ D need not be included in Equation 9.5.2.7-2 when considering foundation overturning.

For Equation 16-5 in 780 CMR 1605.2.1 or 16-10 in 780 CMR1605.3.1:

EQUATION 9.5.2.7-1

$$E = \rho Q_E + 0.2\, S_{DS}$$

For Equation 16-6 in 780 CMR 1605.2.1 or 16-2) in 780 CMR 1605.3.1:

EQUATION 9.5.2.7-2

$$E = \rho Q_E - 0.2 S_{DS} D$$

Where:

E = the effect of horizontal and vertical earthquake-induced forces

S_{DS} = the design spectral response acceleration at short periods obtained from Section 9.4.1.2.5

D = the effect of dead load, D

Q_E = the effect of horizontal seismic (earthquake-induced) forces

ρ = the reliability factor obtained from Section 9.5.2.4.

9.5.2.7.1 Special Seismic Load. Where specifically required by this Code, the special seismic load of Equation 9.5.2.7.1-1 shall be used to compute E for use in Equation 16-5 in 780 CMR 1605.2.1 or Equation 16-10 in 780 CMR 1605.3.1 and the special seismic load of Equation 9.5.2.7.1-2 shall be used to compute E in Equation 16-6 in 780 CMR 1605.2.1 or Equation 16-12 in 780 CMR 1605.3.1:

EQUATION 9.5.2.7.1-1

$$E = \Omega_o Q_E + 0.2\, S_{DS} D$$

EQUATION 9.5.2.7.1-2

$$E = \Omega_o Q_E - 0.2\, S_{DS} D$$

The value of the quantity $\Omega_o\, Q_E$ in Equations 9.5.2.7.1-1 and 9.5.2.7.1-2 need not be taken greater than the capacity of other elements of the structure to transfer force to the component under consideration.

Where allowable stress methodologies are used with the special load of this Section applied in Equation 16-10 or 16-12 of 780 CMR 1605.3.1, allowable stresses are permitted to be determined using an allowable stress increase of 1.1. This increase shall not be combined with increases in allowable stresses or load combination reductions otherwise permitted by this standard or the material reference standard except that combination with the duration of load increases permitted in 780 CMR 23.00 is permitted.

9.5.2.8 Deflection, Drift Limits, and Building Separation. The design story drift (Δ) as determined in Section 9.5.5.7 or 9.5.6.6, shall not exceed the allowable story drift (Δ_a) as obtained from Table 9.5.2.8 for any story. For structures with significant torsional deflections, the maximum drift shall include torsional effects. All portions of the structure shall be designed and constructed to act as an integral unit in resisting seismic forces unless separated by a distance sufficient to avoid damaging contact under total deflection δ_x as determined in Section 9.5.5.7 and below. All structures shall be separated from adjoining structures. Separations shall allow for the displacement δ_M. Adjacent structures on the same property shall be separated by at least δ_{MT}, at all levels, where

EQUATION 9.5.2.8-1

$$\delta_{MT} = \sqrt{[(\delta_{M1})^2 + (\delta_{M2})^2]}$$

and δ_{M1} and δ_{M2} are the displacements of the adjacent buildings. When a structure adjoins a property line not common to a public way, that structure shall also be set back from the property line by at least the displacement, δ_M, of that structure.

Exception. Smaller separations or property line setbacks shall be permitted when justified by engineering analyses based on maximum expected ground motions.

9.5.2.9 Foundation Walls and Retaining Walls. Exterior foundation walls and retaining walls shall be designed to resist at least the superimposed effects of the total static lateral soil and ground water pressures, excluding the pressure caused by any temporary surcharge, plus an earthquake force, F_w, for horizontal backfill surface, equal to:

EQUATION 9.5.2.9

$$F_w = 0.375(S_1)(F_v)(Y_t)(H)^2$$

where S_1 is the maximum considered earthquake spectral response acceleration at a period of 1-second from Table 1604.10 of the Massachusetts State Building Code, F_v is the soil amplification factor from Table 9.4.1.2.4b, Y_t is the total unit weight of the soil, and H is the height of the wall measured as the difference in elevation of finished ground surface or floor in front of and behind the wall.

Surcharges which are applied over extended periods of time shall be included in the total static lateral soil pressure and their earthquake lateral force shall be computed and added to the force determined above. The earthquake force from the backfill shall be distributed as an inverse triangle over the height of the wall.

The point of application of the earthquake force from an extended duration surcharge shall be determined on an individual case basis. If the backfill or the existing soil behind the backfill consists of loose saturated granular soil, the potential for liquefaction of the backfill or existing soil adjacent to the wall during seismic loading shall be evaluated in accordance with the requirements of 780 CMR 1804.6. If the backfill or existing soil beyond the backfill is potentially subject to liquefaction, the increase in design lateral load on the foundation wall or retaining wall shall be determined by a registered professional engineer, registered in the Commonwealth of Massachusetts.

For use in wall strength design, a load factor of 1.43 times the earthquake force calculated above shall be applied.

9.5.3 Effective Seismic Weight. The effective seismic weight, *W*, of the structure shall include the total dead load and other loads listed below:

1. In areas used for storage, a minimum of 25% of the floor live load (floor live load in public garages and open parking structures need not be included).
2. Where an allowance for partition load is included in the floor load design, the actual partition weight or a minimum weight of 10 psf (0.48*kN/m2*) of floor area, whichever is greater.
3. Total operating weight of permanent equipment.
4. 50 % of the roof snow load.

9.5.5.2 Seismic Base Shear. The seismic base shear *(V)* in a given direction shall be determined in accordance with the following equation:

EQUATION 9.5.5.2-1

$$V = C_S W$$

where

Cs = the seismic response coefficient determined in accordance with Section 9.5.5.2.1

W = the effective seismic weight of the structure as defined in Section 9.5.3.

9.6 Architectural, Mechanical, and Electrical Components and Systems.

9.6.1 General. Section 9.6 establishes minimum design criteria for architectural, mechanical, electrical, and non-structural systems components, and elements permanently attached to structures including supporting structures and attachments (hereinafter referred to as "components") The design criteria establish minimum equivalent static force levels and relative displacement demands for the design of components and their attachments to the structure, recognizing ground motion and structural amplification, component toughness and weight, and performance expectations. Seismic Design Categories for structures are defined in Section 9.4.2. For the purposes of this Section, components shall be considered to have the same Seismic Design Category as that of the structure that they occupy or to which they are attached unless otherwise noted.

This Section also establishes minimum seismic design force requirements for nonbuilding structures that are supported by other structures where the weight of the nonbuilding structure is less than 25% of the combined weight of the nonbuilding structure and the supporting structure. Seismic design requirements for nonbuilding structures that are supported by other structures where the weight of the nonbuilding structure is 25% or more of the combined weight of the nonbuilding structure and supporting structure are prescribed in Section 9.14. Seismic design requirements for nonbuilding structures that are supported at grade are prescribed m Section 9.14; however, the minimum seismic design forces for nonbuilding structures that are supported by another structure shall be determined in accordance with the requirements of Section 9.6.1.3 with R_p equal to the value of R specified in Section 9.14 and $a_p = 2.5$ for nonbuilding structures with flexible dynamic characteristics and $a_p = 1.0$ for nonbuilding structures with rigid dynamic characteristics. The distribution of lateral forces for the supported nonbuilding structure and all nonforce requirements specified in Section 9.14 shall apply to supported nonbuilding structures.

In addition, all components are assigned a component importance factor (I_p) in this chapter. The default value for I_p is 1.00 for typical components in normal service. Higher values for I_p are assigned for components, which contain hazardous substances, must have a higher level of assurance of function, or otherwise require additional attention because of their life safety characteristics. Component importance factors are prescribed in Section 9.6.1.5.

All architectural, mechanical, electrical, and other non-structural components in structures shall be designed and constructed to resist the equivalent static forces and displacements determined in accordance with this Section. The design and evaluation of support structures and architectural components and equipment shall consider their flexibility as well as their strength.

Exceptions: The following components are exempt from the requirements of this Section:

1. Not Used
2. Non-fire-resistance rated ceilings and access floors in Seismic Design Category B and C structures which are in Seismic Use Group I.
3. Mechanical and Electrical components in structures assigned to Seismic Design Category B provided the Importance Factor I = 1.0.
4. Mechanical and Electrical components in structures assigned to Seismic Design Category C provided the Importance factor I = 1.0 and having $a_p = 1.0$, other than elevator components and systems in buildings more than 70 feet in height.
5. Mechanical and electrical components in Seismic Design Category D, where $I_p = 1.0$ and flexible connections between the components and associated ductwork, piping, and conduit are provided and that are mounted at 4 ft (1.22 m) or less above a floor level and weigh 400 lb (1780 N) or less.
6. Mechanical and electrical components in Seismic Design Category D, weighing 20 lbs (95 N) or less where $I_p = 1.0$ and flexible connections between the components and associated ductwork, piping, and conduit are provided, or for distribution systems, weighing 5 lb/ft (7 N/m) or less.

The functional and physical interrelationship of components and their effect on each other shall be designed so that the failure of an essential or nonessential architectural, mechanical, or electrical component shall not cause the failure of a nearby essential architectural, mechanical, or electrical component.

9.6.1.5 Component Importance Factor. The component importance factor (I_p) shall be selected as follows:

$I_p =$ 1.5 for life safety component required to function after an earthquake (*e.g.*, fire protection sprinkler system)

$I_p = 1.5$ for stair and elevator enclosures and for non-loadbearing walls and/or partitions that form the exit from the facility and are required by other provisions of the code to provide a fire resistance rating for protection from smoke and fire for the means of egress path leading from the interior of the building to an exit discharge

$I_p = 1.5$ for component that contains hazardous content

$I_p = 1.5$ for storage racks in structures open to the public (*e.g.*, warehouse retails stores)

$I_p = 1.0$ for all other components

In addition, for structures in Seismic Use Group III:

$I_p = 1.5$ for all components needed for continued operation of the facility or whose failure could impair the continued operation of the facility

9.6.1.7 Construction Documents. Construction documents shall show the design and anchorage of all architectural, mechanical and electrical components and systems to the structure, except that the construction documents may alternatively include performance specifications for the design and detailing of components and systems and their anchorage. The performance specifications shall require that the design and detailing of components and systems be prepared by a professional engineer(s) registered in the Commonwealth of Massachusetts.

Table 9.6.1.7
CONSTRUCTION DOCUMENTS
DELETED

9.6.2.2 Architectural Component Forces and Displacements. Architectural components shall meet the force requirements of Section 9.6.1.3 and Table 9.6.2.2.

Components supported by chains or otherwise suspended from the structural system above are not required to meet the lateral seismic force requirements and seismic relative displacement requirements of this Section provided that they cannot be damaged to become a hazard or cannot damage any other component when subject to seismic motion and they have ductile or articulating connections to the structure at the point of attachment. The gravity design load for these items shall be three times their operating load. Anchorage forces for concrete or masonry walls shall not be less than required by Section 9.5.2.6.

TABLE 9.6.2.2
ARCHITECTURAL COMPONENT COEFFICIENTS

Architectural Component or Element	a_p[a]	R_p[b]
Interior Nonstructural Walls and Partitions:		
Plain (unreinforced) masonry walls are not permitted.	NP[c]	NP
All other walls and partitions	1	2.5
Cantilever Elements (Unbraced or Braced to Structural Frame Below Its Center of Mass) Parapets and cantilever anterior nonstructural walls.	2.5	2.5
Chimneys and stacks when laterally braced or supported by the structural frame.	2.5	2.5
Cantilever Elements (Braced to Structural Frame Above Its Center of Mass)		
Parapets	1.0	2.5
Chimneys and stacks	1.0	2.5
Exterior nonstructural walls	1.0[b]	2.5
Exterior Nonstructural Wall Elements and Connections		
Wall element	1.0	2.5
Body of wall panel connections	1.0	2.5
Fasteners of the connecting system	1.25	1
Veneer		
Limited deformability elements and attachments	1.0	2.5
Low deformability elements and attachments	1.0	2.5
Penthouses (Except when Framed by an Extension of the Building Frame)	2.5	3.5
Ceilings		
All	1.0	2.5
Cabinets		
Storage cabinets and laboratory equipment	1.0	2.5
Access Floors		
Special access floors (designed in accordance with Section 9.6.2.7.2)	1.0	2.5
All other	1.0	1.5
Appendages and Ornamentations	2.5	2.5
Signs and Billboards	2.5	2.5
Other Rigid Components		
High deformability elements and attachments	1.0	3.5
Limited deformability elements and attachments	1.0	2.5
Low deformability materials and attachments	1.0	1.5
Other Flexible Components		
High deformability elements and attachments	2.5	3.5
Limited deformability elements and attachments	2.5	2.5
Low deformability materials and attachments	2.5	1.5

a. A lower value for a_p shall not be used unless justified by detailed dynamic analysis. The value for a_p shall not be less than 1.00. The value of $a_p = 1$ is for equipment generally regarded as rigid and rigidly attached. The value of $a_p = 2.5$ is for equipment generally regarded as flexible or flexibly attached. *See* Section 9.2.1 for definitions of rigid and flexible.

b. Where flexible diaphragms provide lateral support for walls and partitions, the design forces for anchorage to the diaphragm shall be as specified in Section 9.5.2.6.

c. NP = Not Permitted.

9.6.2.6.2.1 Seismic Design Categories B and C. Suspended ceilings in Seismic Design Categories B and C shall be designed and installed in accordance with the CISCA recommendations for seismic Zones 0-2, (Ref. 9.6-16), except that seismic forces shall be determined in accordance with Sections 9.6.1.3 and 9.6.2.6.1. Note that design of non-fire-resistance rated ceilings in Seismic Design Categories B and C which are in Seismic Use Group I need not meet these requirements.

Sprinkler heads and other penetrations in Seismic Design Category C shall have a minimum of 1/4 in. (6 mm) clearance on all sides.

9.13.6.2.3 Fire Resistance. Fire resistance ratings of the isolation system shall comply with 780 CMR 714.7.

9.14.6.6.1 General. Piers and wharves are structures located in waterfront areas that project into a body of water or parallel the shoreline. A pier or wharf supporting a building or buildings shall be designed considering soil-structure interaction and the dynamic properties of the combined building/pier or building/wharf structure for earthquake loads specified in this Code.

780 CMR 1616.0 THROUGH 1623.0 RESERVED

780 CMR 1624.0 *IN-SITU* LOAD TESTS

1624.1 General. Whenever there is a reasonable doubt as to the stability or load-bearing capacity of a completed building, structure or portion thereof for the expected loads, an engineering assessment shall be required. The engineering assessment shall involve either a structural analysis or an in-situ load test, or both. The structural analysis shall be based on actual material properties and other as-built conditions that affect stability or load-bearing capacity, and shall be conducted in accordance with the applicable design standard. If the structural assessment determines that the load-bearing capacity is less than that required by the code, load tests shall be conducted in accordance with 780 CMR 1624.2. If the building, structure or portion thereof is found to have inadequate stability or load-bearing capacity for the expected loads, modifications to ensure structural adequacy or the removal of the inadequate construction shall be required.

1624.2 Test Standards. Structural components and assemblies shall be tested in accordance with the appropriate material standards listed in 780 CMR 35.00. In the absence of a standard that contains an applicable load test procedure, the test procedure shall be developed by a registered design professional and approved. The test procedure shall simulate loads and conditions of application that the completed structure or portion thereof will be subjected to in normal use.

1624.3 *In-situ* Load Tests. In-situ load tests shall be conducted in accordance with 780 CMR 1624.3.1 or 1624.3.2 and shall be supervised by a registered design professional. The test shall simulate the applicable loading conditions specified in 780 CMR 16.00 as necessary to address the concerns regarding structural stability of the building, structure or portion thereof.

1624.3.1 Load Test Procedure Specified. Where a standard listed in 780 CMR 35.00 contains an applicable load test procedure and acceptance criteria, the test procedure and acceptance criteria in the standard shall apply. In the absence of specific load factors or acceptance criteria, the load factors and acceptance criteria in 780 CMR 1624.3.2 shall apply.

1624.3.2 Load Test Procedure Not Specified. In the absence of applicable load test procedures contained within a standard referenced by 780 CMR or acceptance criteria for a specific material or method of construction, such existing structure shall be subjected to a test procedure developed by a registered design professional that simulates applicable loading and deformation conditions. For components that are not a part of the seismic load-resisting system, the test load shall be equal to two times the unfactored design loads. The test load shall be left in place for a period of 24 hours. The structure shall be considered to have successfully met the test requirements where the following criteria are satisfied:

1. Under the design load, the deflection shall not exceed the limitations specified in 780 CMR 1604.3.
2. Within 24 hours after removal of the test load, the structure shall have recovered not less than 75% of the maximum deflection.
3. During and immediately after the test, the structure shall not show evidence of failure.

780 CMR 1625.0 ALTERNATIVE TEST PROCEDURE

1625.1 General. For materials and assemblies that are not specifically provided for in 780 CMR, the design strengths and permissible stresses shall be established by tests or a combination of tests and structural analysis.

1625.2 Tests by Approved Agencies. The building official shall accept duly authenticated reports from approved agencies in respect to the quality and manner of use of new materials or assemblies as provided for in 780 CMR 109.4.

1625.3 Cost of Tests. The cost of all tests and other investigations required under the provisions of

780 CMR shall be borne by the permit applicant.

780 CMR 1626.0 TEST SAFE LOAD

1626.1 Where Required. Where proposed construction is not capable of being designed by approved engineering analysis, or where proposed construction design method does not comply with the applicable material design standard, the system of construction or the structural unit and the connections shall be subjected to the tests prescribed in 780 CMR 1627.0. The building official shall accept certified reports of such tests conducted by an approved testing agency, provided that such tests meet the requirements of 780 CMR and approved procedures.

780 CMR 1627.0 PRECONSTRUCTION LOAD TESTS

1627.1 General. In evaluating the physical properties of materials and methods of construction that are not capable of being designed by approved engineering analysis or that do not comply with applicable material design standards listed in 780 CMR 35.00, the structural adequacy shall be predetermined based on the load test criteria established in 780 CMR 1627.0.

1627.2 Load Test Procedures Specified. Where specific load test procedures, load factors and acceptance criteria are included in the applicable design standards listed in 780 CMR 35.00, such test procedures, load factors and acceptance criteria shall apply. In the absence of specific test procedures, load factors or acceptance criteria, the corresponding provisions in 780 CMR 1627.3 shall apply.

1627.3 Load Test Procedures Not Specified. Where load test procedures are not specified in the applicable design standards listed in 780 CMR 35.00, the load-bearing and deformation capacity of structural components and assemblies shall be determined on the basis of a test procedure developed by a registered design professional that simulates applicable loading and deformation conditions. For components and assemblies that are not a part of the seismic load-resisting system, the test shall be as specified in 780 CMR 1627.3.1. Load tests shall simulate the applicable loading conditions specified in 780 CMR 16.00.

1627.3.1 Test Procedure. The test assembly shall be subjected to an increasing superimposed load equal to not less than two times the superimposed design load. The test load shall be left in place for a period of 24 hours. The tested assembly shall be considered to have successfully met the test requirements if the assembly recovers not less than 75% of the maximum deflection within 24 hours after the removal of the test load. The test assembly shall then be reloaded and subjected to an increasing superimposed load until either structural failure occurs or the superimposed load is equal to two and one-half times the load at which the deflection limitations specified in 780 CMR 1627.3.2 were reached, or the load is equal to two and one-half times the superimposed design load. In the case of structural components and assemblies for which deflection limitations are not specified in 780 CMR 1627.3.2, the test specimen shall be subjected to an increasing superimposed load until structural failure occurs or the load is equal to two and one-half times the desired superimposed design load. The allowable superimposed design load shall be taken as the lesser of:

1. The load at the deflection limitation given in 780 CMR 1627.3.2.
2. The failure load divided by 2.5.
3. The maximum load applied divided by 2.5.

1627.3.2 Deflection. The deflection of structural members under the design load shall not exceed the limitations in 780 CMR 1604.3.

1627.4 Wall and Partition Assemblies. Load-bearing wall and partition assemblies shall sustain the test load both with and without window framing. The test load shall include all design load components. Wall and partition assemblies shall be tested both with and without door and window framing.

1627.5 Exterior Window and Door Assemblies. The design pressure rating of exterior windows and doors in buildings shall be determined in accordance with 780 CMR 1627.5.1 or 1627.5.2.

Exception. Structural wind load design pressures for window units smaller than the size tested in accordance with 780 CMR 1627.5.1 or 1627.5.2 shall be permitted to be higher than the design value of the tested unit provided such higher pressures are determined by accepted engineering analysis. All components of the small unit shall be the same as the tested unit. Where such calculated design pressures are used, they shall be validated by an additional test of the window unit having the highest allowable design pressure.

1627.5.1 Aluminum, Vinyl and Wood Exterior Windows and Glass Doors. Aluminum, vinyl and wood exterior windows and glass doors shall be labeled as conforming to AAMA/NWWDA 101/I.S.2 or 101/I.S.2/NAFS. The label shall state the name of the manufacturer, the approved labeling agency and the product designation as specified in AAMA/NWWDA 101/I.S.2 or 101/I.S.2/NAFS. Products tested and labeled as conforming to AAMA/NWWDA 101/I.S.2 or 101/I.S.2/NAFS shall not be subject to the requirements of 780 CMR 2403.2 and 2403.3.

1627.5.2 Exterior Windows and Door Assemblies Not Provided for in 780 CMR 1627.5.1. Exterior window and door assemblies shall be tested in accordance with ASTM E 330.

Exterior window and door assemblies containing glass shall comply with 780 CMR 2403. The design pressure for testing shall be calculated in accordance with 780 CMR 16.00. Each assembly shall be tested for ten seconds at a load equal to 1.5 times the design pressure.

1627.6 Test Specimens. Test specimens and construction shall be representative of the materials, workmanship and details normally used in practice. The properties of the materials used to construct the test assembly shall be determined on the basis of tests on samples taken from the load assembly or on representative samples of the materials used to construct the load test assembly. Required tests shall be conducted or witnessed by an approved agency.

780 CMR 17.00

QUALITY ASSURANCE DURING CONSTRUCTION

780 CMR 17.00 is unique to Massachusetts

780 CMR 1701.0 GENERAL

1701.1 Scope. The requirements in 780 CMR 17.00 provide minimum standards for quality assurance of materials, fabrication and construction of select components, assemblies and systems for structures that are designed by one or more registered design professionals.

1701.2 Purpose. The purpose of the quality assurance requirements in 780 CMR 17.00 is to provide assurance to the responsible registered design professional(s) (RDP(s)), the owner, and the authority having jurisdiction (AHJ) that materials, fabrication and construction regulated by 780 CMR 17.00 comply with the design as delineated in the construction documents.

1701.3 Extent of Quality Assurance. For the purposes of 780 CMR 17.00, quality assurance shall be defined as tests, inspections and observations of the work to such an extent that they provide reasonable evidence and documentation to the responsible RDP that the work is being constructed in accordance with the RDP's design. Said RDP shall determine the frequency and extent of the applicable tests, inspections, and observations required in 780 CMR 17.00.

1701.4 Structures Requiring Quality Assurance. A quality assurance program is required for structures, components, assemblies or systems which are required to be designed by a RDP.

Exceptions:

1. Buildings in Use Group R-3 – Note that townhouses are treated as R-2 use.
2. Structures of 50,000 cu ft of volume or less, out to out of walls and roofs and down to the top of the floor on ground, except as otherwise required by the AHJ.

1701.5 Involvement of the Owner and Registered Design Professional. The owner shall provide for the responsible RDPs to prepare, direct, and monitor a quality assurance program that reflects the requirements of 780 CMR 17.00. As specified hereinafter, and as applicable, each RDP responsible for the design of components, assemblies or systems governed by 780 CMR 17.00 shall prepare, direct, and monitor a quality assurance program for those parts for which the RDP has design responsibility, or for which the RDP develops criteria for design to be performed by others. The responsible RDP shall select qualified agents to assist with the implementation of the quality assurance program.

1701.6 Responsibilities of the Contractor. The contractor shall provide a quality control program for the construction regulated under 780 CMR 17..00 Quality assurance and its implementation does not relieve the contractor of its responsibilities for quality control of the construction, for compliance with the project construction documents, nor for any design for which it is responsible.

1701.6.1. Whenever the owner reserves a quality control procedure for itself in the construction documents, such quality control procedure shall be made part of the required quality assurance program and shall be directed and monitored by the responsible RDP.

1701.7 Building Permit. The quality assurance programs, including the required tests, inspections and observations, shall be submitted by the permit applicant as a condition for issuance of a building permit.

1701.8 Reports. As fabrication and construction progress, inspection reports and records of tests and inspections shall be forwarded to the responsible RDP for review and approval. The RDP shall maintain all test and inspection records and make them available to the AHJ in the manner requested by the AHJ. The RDP shall note any unresolved construction deficiencies in writing to the AHJ and the owner.

1701.9 Remedial Action. When deviations from design requirements that require remedial action are determined during tests, inspections or observations, the responsible RDP shall promptly report such to the contractor. If the contractor fails to have required corrective action performed, this lack of action shall be reported to the AHJ and the owner.

1701.10 Final Report. Prior to issuance of a certificate of occupancy, a final report stating that the quality assurance program has been satisfactorily completed, and that any deficiencies reported to the AHJ have been rectified, shall be submitted by the responsible RDP to the owner and the AHJ.

1701.11 Performance Specifications. The responsible RDP shall identify, in the quality assurance program submitted with the application for building permit, components, assemblies or systems that the RDP has specified to be designed by a RDP under the control of the contractor, from a performance specification provided by the responsible RDP. The responsible RDP shall review the design of these elements or systems for conformance to the performance specification and shall include them in the quality assurance program.

1701.12 Reference Standards. Where standards referenced by 780 CMR contain provisions for quality assurance, the responsible RDP shall determine which of the quality assurance requirements are appropriate and shall include the appropriate requirements in his or her quality assurance program. Notwithstanding any other provision in 780 CMR to the contrary, the responsible SER is not obliged to include in his or her quality assurance program any requirement for quality assurance from the referenced standards that he or she determines is not appropriate.

1701.13 Testing Standards. Testing methods for quality assurance shall be the same as required by 780 CMR and its referenced standards for determining acceptance of materials and their installation.

780 CMR 1702.0 DEFINITIONS

AGENT. Qualified company or individual assigned to execute the specific tests and inspections required by the quality assurance program.

CONTRACTOR. The entity in control of construction.

CONSTRUCTION DOCUMENTS. The plans, specifications, approved shop drawings and all other documents that describe the design of a construction project for which a building permit has been issued by the AHJ.

CURTAIN WALL. An exterior enclosure wall of a building, including all of its components.

FABRICATOR. The entity performing off-site manufacture and/or assembly of construction components or systems.

QUALITY ASSURANCE. See 780 CMR 1701.3.

QUALITY ASSURANCE PROGRAM. The program prepared and monitored by the responsible Registered Design Professional (RDP)

QUALITY CONTROL. The operational procedures that contractors have in place to insure compliance with construction documents.

REGISTERED DESIGN PROFESSIONAL (RDP). As defined in 780 CMR 2.00.

SPRAYED FIRE RESISTIVE MATERIAL. A cementitious or fibrous material that is spray applied to structural elements, walls, floors and roof to provide fire resistive protection.

STRUCTURAL ENGINEER OF RECORD (SER). The responsible RDP whose professional seal of registration and signature appear on the structural design documents submitted with the building permit application, or the alternate SER who succeeds the SER as provided in 780 CMR 1704.3.

780 CMR 1703.0 QUALITY ASSURANCE FOR STRUCTURAL COMPONENTS AND ASSEMBLIES

1703.1 General. The responsible RDP shall prepare a quality assurance program for materials, fabrication and construction that includes the structural tests, inspections and observations required by 780 CMR 1703.0.

1703.2 Structural Observations. The responsible RDP or a RDP designated by the responsible RDP shall conduct site visits at significant construction stages, to verify that required structural tests and inspections are being performed and to make observations for general conformance with the RDP's design as delineated in the Construction Documents.

1703.3 Structural Tests and Inspections. The quality assurance program shall include a list of structural tests and inspections that are to be conducted during fabrication and installation in accordance with the provisions in 780 CMR 17.00. The program shall include:

(a) a complete list of materials and work requiring structural tests and inspections;
(b) the tests and inspections to be performed;
(c) a list of qualified agents for the project; and
(d) the frequency and extent of tests and inspections.

1703.3.1 The structural engineer of record (SER) shall list in the program of structural tests and inspections the names of all responsible RDPs who are not under the SER's control and who have performed design of structural components and assemblies for the project, together with the work that each of these responsible RDPs has performed.

1703.3.2 Waiver of Structural Inspection by the SER. Where, in the opinion of the SER, any portion of the contractor's quality control program meets the inspection and test requirements of 780 CMR 17.00, the SER may reduce the specified quality assurance program following approval by the AHJ. When this is done, the final inspection report shall include reference to the results of those inspections performed by the contractor. Also, as construction progresses, the contractor shall submit reports of the affected inspections and tests to the SER.

1703.4 Alternate Structural Engineer of Record (Alternate SER). If, for any reason, the SER cannot continue with the project until the completion of the construction of the structural components and assemblies, the owner shall retain or otherwise provide for an alternate qualified RDP, to be known as the *alternate SER*, to review the design of the SER, assume full responsibility for that design, and to prepare (if necessary), direct, and monitor the quality assurance program required by 780 CMR 1703.0. The alternate SER shall make any necessary changes to the design and the quality assurance program of the SER that he deems is necessary.

1703.5 Inspection of Fabricators. Where fabrication of structural components or assemblies is being performed in an off-site facility, fabricators shall be inspected as follows:

1703.5.1 Prefabrication Inspection. The inspector shall verify that fabricators designated for the project maintain complete and sufficient quality control procedures that assure the fabricator's ability to conform to approved construction documents.

Exception. Prefabrication inspection may be waived by the RDP if the designated fabricator maintains an agreement with a recognized independent inspection or quality control agency that conducts periodic in-plant inspections at the fabricator's plant, at a frequency that will insure the fabricator's ability to conform to the construction documents. This waiver does not eliminate structural inspection during fabrication in accordance with 780 CMR 1703.4.2.

1703.5.2 Inspection During Fabrication. During fabrication the agent shall confirm that the fabricator is suitably executing its quality control procedures and producing a product that conforms to the construction documents. However, structural tests and inspections during fabrication may be reduced, at the option of the RDP, if the fabricator meets the Exception under 780 CMR 1703.4.1.

1703.6 *In situ* Soils and Controlled Structural Fill. Structural tests and inspection for bearing capacity of *in situ* soils shall be as required in Table 1703.6a. Structural tests and inspections for controlled structural fill designed to support the structure shall be as required in Table 1703.6b.

TABLE 1703.6a *IN SITU* BEARING STRATA FOR FOOTINGS

Item	**Scope** (Frequency determined by responsible RDP)
Bearing Strata QC Review	Review contractor's field quality control procedures.
General Excavation	Inspect strata for conformance to the structural drawings, specifications, and/or geotechnical report. Ensure that excavation is to proper depth or material. Ensure that excavation is controlled and contains no unsuitable materials.
Bearing Surfaces of Footings	Inspect bearing surfaces for conformance to the requirements of the structural drawings, specifications, and/or geotechnical report.

TABLE 1703.6b CONTROLLED STRUCTURAL FILL (PREPARED FILL)

Item	**Scope** (Frequency determined by responsible RDP)
Controlled Structural Fill QC Review	Review contractor's field quality control procedures.
Fill Material	Test material for conformance to specifications or geotechnical report. Perform laboratory compaction tests in accordance with the specifications to determine optimum water content and maximum dry density.
Installation of Controlled Structural Fill	Provide full-time inspection of the installation, in accordance with the specifications.
Density of Fill	Perform field density tests of the in-place fill in accordance with the specifications.

1703.7 Foundations. Structural tests and inspection for foundation systems shall be as required in Table 1703.7a and Table 1703.7b.

1703.8 Cast-in-place Concrete Construction. Structural tests and inspection for cast-in-place concrete construction, including post-tensioned concrete, shall be as required in Table 1703.8.

Exceptions:

1. Concrete slabs supported directly on the ground that do not support other structural elements.
2. Concrete patios, driveways and sidewalks, on grade.

TABLE 1703.7a PILE FOUNDATIONS

Item	**Scope** (Frequency determined by responsible RDP)
Pile Foundations QC Review	Review Contractor's quality control procedures.
Pile Materials	Inspect documents identifying pile material and certifying grade of material for conformance to the Contract Documents, and that the identification is maintained from the point of manufacture to the point of delivery to the site.
Pile Installation	Perform full time inspection of installation. Maintain accurate records for each pile. Review final location of each pile.
Precast Concrete Piles	Perform structural tests and inspections as listed under category *Precast Concrete Construction.*
Cast-in-place Concrete and Reinforcing Steel Components of Piles	Perform structural tests and inspections as listed under category *Cast-in-Place Concrete Construction.*
Specialty Piles	Responsible RDP to provide inspections and testing criteria for each type of specialty pile.

TABLE 1703.7b PIER FOUNDATIONS

Item	**Scope** (Frequency determined by responsible RDP)
Pier Foundation QC Review	Review Contractor's quality control procedures. Review scope and frequency of testing and inspections.
Pier Installation	Perform full time inspection of installation. Maintain accurate records for each pier. Verify bearing strata for geotechnical requirements.
Cast-in-place Concrete and Reinforcing Steel Components of Piers	Perform structural tests and inspections as listed under category *Cast-in-Place Concrete Construction.*

TABLE 1703.8 CAST-IN-PLACE CONCRETE CONSTRUCTION

Item	**Scope** (Frequency determined by responsible RDP)
Cast-in-place Concrete Construction QC Review	Review Contractor's field quality control procedures. Review frequency and scope of field testing and inspections.
Mix Design	Review mix designs prior to placement. Verify use of required mix design.
Materials	Review material certifications for conformance to specifications.
Batching Plant	Review Plant quality control procedures and batching and mixing methods.
Reinforcement Installation	Inspect reinforcing for size, quantity, condition and placement. Verify adequate cover per specifications.
Anchor Rods	Inspect anchor rods prior to and during placement of concrete.
Post-Tensioning Operations	Inspect tensioning and anchorage of tendons. Inspect grouting of bonded tendons. Verify concrete strength prior to stressing of tendons and removal of shores and forms from beams and structural slabs.
780 CMRFormwork	Inspect form sizes for proper sizes of concrete members.
Concrete Placement and Sampling Fresh Concrete	Observe concrete placement operations. Verify conformance to specifications including cold-weather and hot-weather placement procedures. Perform slump, density and air content tests at point of discharge.
Evaluation of Concrete Strength	Test and evaluate in accordance with the specifications.
Curing and Protection	Observe procedures for conformance to the specifications.
Welding Reinforcing Steel	Verify weldability of reinforcing steel other than ASTM A706.
Mechanical Reinforcing Splices	Verify proper embedment, joint fit-up and tightness of mechanical parts.
Shotcrete	Inspection of shotcrete placement for proper application techniques.

1703.9 Precast Concrete. Structural tests and inspection for precast concrete shall be as required in Table 1703.9 and 780 CMR 1703.5.

1703.10 Masonry Construction. Structural tests and inspection of masonry materials and construction shall be as required in Table 1703.10.

TABLE 1703.9 PRECAST CONCRETE CONSTRUCTION

Item	**Scope** (Frequency determined by responsible RDP)
Precast Concrete Construction QC Review	Review Contractor's field quality control procedures. Review frequency and scope of field testing and inspections.
Plant Certification/Quality Control Procedures	Review Plant quality control procedures. Inspect plant storage and handling procedures. Confirm that approved submittals are in the plant and are being used for fabrication. Review welder's certifications.
Materials	Review material certifications for conformance to specifications.
Formwork	Inspect form sizes.
Reinforcement Installation	Inspect reinforcing and prestressing strands for size, quantity, condition and placement for conformance with Contract Documents, and responsible RDP approved submittals. Inspect welding.
Mix Design	Review mix designs prior to placement. Verify use of required mix design.
Concrete Placement	Inspect concrete placement procedures.
Curing and Protection	Inspect for maintenance of specified curing temperatures and techniques.
Evaluation of Concrete Strength	Test for conformance to specifications in accordance with approved submittal.
Prestress Operation	Inspect application of prestressing forces. Inspect grouting of bonded, post-tensioned, prestressing tendons.
Site Erected Precast Elements	Inspect for compliance with responsible RDP approved submittals and Contract Documents. Review site storage and handling procedures for consistency with design of precast elements. Verify that responsible RDP approved erection drawings are on site and are being used for erection. Verify that responsible RDP specified erection procedures are being followed. Observe tensioning and grouting for all bonded post-tensioned tendons. Review welder's certifications. Monitor finished products for structural defects.
Connections/Embedded Items	Inspect interface connections including end and edge doweling. Inspect embedments for proper location. Inspect shimming, bearing, bolting and welding of connections.
Field Correction of Fabricated Items	Review documentation of responsible RDP approved repair and verify completion of repairs.

TABLE 1703.10 MASONRY CONSTRUCTION

Item	**Scope** (Frequency determined by responsible RDP)
Masonry Construction QC Review	Review Contractor's field quality control procedures.
Materials	Review material certifications for conformance to specifications.
Evaluation of Masonry Strength (f_M=)	Verify strength in accordance with the specifications.
Proportioning, Mixing and Consistency of Mortar and Grout	Inspect field-mixing procedures for conformance to the specifications.
Installation of Masonry	Inspect placement for conformance to the specifications. Verify cleanout hole locations (high lift grouting). Verify the installation of bond beams and special shapes.
Reinforcement Installation	Inspect reinforcing steel for size, quantity, condition and placement for conformance to responsible RDP approved submittals and Contract Documents. Inspect welding of reinforcement and review welder's certifications. Inspect mechanical splices.
Grouting Operations	Inspect grouting procedures for conformance with the specifications. Inspect cells prior to grouting. Assure observation holes have been installed prior to high lift grouting.
Weather Protection	Inspect protection for cold and hot weather for conformance with the specifications.
Anchorage	Inspect anchorage of masonry to other construction for conformance to the Contract Documents.

1703.11 Steel Construction

1703.11.1Structural Steel. Structural tests and inspection for structural steel materials, fabrication and erection shall be as required in 780 CMR 1703.5 and Table 1703.11a.

1703.11.2 Light Gauge Metal Framing. Structural tests and inspection for light gauge metal framing (cold-formed steel) materials, fabrication, and erection shall be as required in 780 CMR 1703.5 and Table 1703.11b.

TABLE 1703.11a STRUCTURAL STEEL

Item	**Scope** (Frequency determined by responsible RDP)
Steel Construction QC Review	Review Contractor's field quality control procedures. Review frequency and scope of field testing and inspections.
Fabricator Certification/ Quality Control Procedures	Review each Fabricator's quality control procedures.
Fabricator Inspection	Inspect in-plant fabrication, or review Fabricator's approved Independent Inspection Agency's reports.
Materials	Review materials certifications for conformance to the specifications.
Anchor Rods	Review Contractor's as-built survey. Verify that all anchor rods have been properly torqued and have adequate fit-up.
Bolting	Test and inspect bolted connections in accordance with specifications. Verify bolt size and grade.
Welding	Check welder qualifications. Visually inspect fillet welds and test full-penetration field welds in accordance with specifications.
Shear Connectors	Inspect for size and placement. Test for proper weld attachment.
Structural Framing, Details and Assemblies	Inspect for size, grade of steel, camber, installation and connection details. Check against approved construction documents and shop drawings.
Open Web Steel Joists	Inspect for size, placement, bridging, bearing and connection to structure. Visually inspect all welds of a minimum of 5% of the joists, randomly selected.
Expansion and Adhesive Anchors	Review installation procedures for both mechanical anchors and adhesive anchors. Verify that materials are suitable for job conditions.
Metal Decking	Verify gage, width, and type. Inspect placement, laps, welds, side lap attachment and screws or other mechanical fasteners. Check welder qualifications.
Field Correction of Fabricated Items	Review documentation of responsible RDP approved repair and verify completion of repairs

TABLE 1703.11b LIGHT GAUGE METAL FRAMING

Item	**Scope** (Frequency determined by responsible RDP)
Light Gauge Metal Framing QC Review	Review of Contractor's field quality control procedures. Review scope of testing and inspections.
Fabricator's Quality Control Procedures.	Review fabricator's quality control procedures.
Material Certification.	Review for conformance to contract documents.
Fabrication Inspection.	Inspect in-plant fabrication or on-site fabrication.
Installation.	Verify that type, size, quantity, location, details, and connections of framing members conform to responsible RDP approved submittals, and the contract documents..
Welding.	Check welders= qualifications. Verify that welding conforms to AWS specifications, responsible RDP approved submittals, and the contract documents. Visually inspect welds.
Other Fasteners.	Verify fastener type and installation procedures. Verify that fasteners conform to responsible RDP approved submittals and the contract documents. Verify that fasteners are installed tight.
Field Correction of Fabricated Items	Review documentation of responsible RDP approved repair and verify completion of repairs.

1703.12 Wood Construction. Structural tests and inspection for conventional, wood framing or engineered wood components and assemblies, including fastening and other connection methods, shall be as required in 780 CMR 1703.5 and Table 1703.12.

TABLE 1703.12 WOOD CONSTRUCTION

Item	**Scope** (Frequency determined by responsible RDP)
Wood Construction QC Review	Review contractors quality control procedures. Review scope and frequency of testing and inspections.
Fabricator Certification/ Quality Control Procedures for prefabricated wood components	Review Fabricator's quality control procedures.
Material Grading	Inspect Lumber for conformance to the Contract Documents. Check moisture content as applicable.
Framing, Details and Connections	Inspect members for size, placement and connection details. Inspect blocking between floors and at posts. Verify proper connection hardware and its installation. Inspect bearing, nailing and completed connections for conformance to the responsible RDP approved submittals and Contract Documents.
Shear Walls, Diaphragms and Hold-downs	Inspect thickness and grade of plywood, blocking, hold-down anchors and the edge and field nailing of the plywood to the framing for conformance to the responsible RDP approved submittals and Contract Documents. Review panelized construction for proper plywood overlaps.
Wood Trusses	Inspect size and location of nail plates, split rings, bolts, or other connection devices for conformance to responsible RDP approved submittals and the Contract Documents. Verify that nails, bolts, hold-down anchors or clips or other devices are tight and otherwise properly installed. Verify that permanent web bracing, including X-bracing has been installed.
Laminated Lumber	Inspect grade, nailing, end bearing and end attachment for conformance to responsible RDP approved submittals and the Contract Documents.
Anchor Bolts	Verify that anchor bolts have been placed as indicated on the plans.

1703.13 Post-installed Anchors into Structural Concrete. Structural tests and inspections for post-installed anchors shall be in accordance with the manufacturer's installation and inspection instructions and in accordance with the installation and inspection instructions of the applicable evaluation report for the anchors. Where acceptance criteria, evaluation reports or manufacturers' installation instructions refer to the term "special inspection" it shall be deemed to mean "Quality Assurance During Construction in accordance with 780 CMR 17.00". Where these criteria, reports, or instructions refer to "special inspector", it shall be deemed to mean the qualified agents selected by the RDP in accordance with 780 CMR 1701.5.

1703.14 Special Cases. A quality assurance program shall be prepared and monitored by the responsible RDP for permitted work that is, in the opinion of the RDP, unusual in nature, such as:

1. Application of structural materials, components, assemblies or systems that are alternatives to those recognized by this code or its applicable reference standards.
2. Construction or installation of structural materials, components, assemblies or systems required to be installed in accordance with manufacturer's instructions that prescribe requirements not recognized by 780 CMR or its applicable reference standards.

TABLE 1704 CURTAIN WALLS (WALL PANELS AND VENEERS)

Item	**Scope** (Frequency determined by responsible RDP)
Curtain Wall QC Review	Review contractors quality control procedures. Review scope and frequency of testing and inspections.
Precast Concrete Panels.	Perform applicable structural tests and inspections as listed under category *Precast Concrete Construction.*
Light Gage Metal Framing for Panels.	Perform applicable structural tests and inspections as listed under category *Light Gage Metal Framing*.
Proprietary Light Weight Curtain Walls Systems.	Review manufacturer's fabrication methods and quality control procedures. Review material certification, and inspect fabrication of structural framing, details, connections, and fasteners for conformance to responsible RDP approved submittals and the contract documents.
Masonry Veneers.	Perform applicable structural tests and inspections as listed under category *Masonry Construction*. Verify that relieving angles, ties to the backup structure, and other structural supports are installed in conformance with the contract documents and responsible RDP approved submittals.
Field Correction of Fabricated Items	Review documentation of responsible RDP approved repair and verify completion of repairs.

TABLE 1705 SPRAYED FIRE RESISTIVE MATERIALS

Item	**Scope** (Frequency determined by responsible RDP)
Sprayed Fire Resistive Materials QC Review	Review contractors quality control procedures. Review scope and frequency of testing and inspections.
Materials	Review material certifications for conformance to specifications.
Installation	Review surfaces to receive sprayed fire resistive materials, temperature at application, equipment and application procedures. Verify installation procedure with manufacturers written instructions.
Testing	Perform bond and density tests.

780 CMR 1704.0 QUALITY ASSURANCE FOR CURTAIN WALL CONSTRUCTION

1704.1 Scope. A quality assurance program shall be prepared and monitored by the responsible RDP in accordance with Table 1704.

780 CMR 1705.0 QUALITY ASSURANCE FOR SPRAYED FIRE RESISTIVE MATERIALS

1705.1 Scope. A quality assurance program for sprayed fire-resistive materials shall be prepared and monitored by the responsible RDP. Tests and inspections shall be as required in Table 1705.

1705.2 Density and Thickness. Density and average thickness of the sprayed fire resistive materials shall be determined in accordance with ASTM E 605 – also see 780 CMR 703.5

1705.3 Bond Strength. The cohesive/adhesive bond strength shall be determined in accordance with the field test specified in ASTM E 736 by testing in-place samples of the sprayed fire resistive material selected as specified in 780 CMR 1705.3.1 and 1705.3.2 – also see 780 CMR 703.5.

1705.3.1 The test samples for determining the cohesive/adhesive bond strength of the sprayed fire resistive materials shall be selected from each floor, roof and wall assembly at the rate of not less than one sample for every 10,000 square feet (929 m^2) or part thereof of the sprayed area in each story – also see 780 CMR 703.5.

1705.3.2 The test samples for determining the cohesive/adhesive bond strength of the sprayed fire resistive materials shall be selected from beams, girders, joists, trusses and columns at the rate of not less than one sample for each type of structural element for each 10,000 square feet (929 m^2) of floor area or part thereof in each story – also see 780 CMR 703.5.

780 CMR 1706.0 QUALITY ASSURANCE FOR SMOKE CONTROL SYSTEMS

1706.1 Scope. A quality assurance program for the installation and operation of smoke control systems shall be prepared and monitored by the responsible RDP. Tests and inspection of smoke control systems shall be performed during erection and prior to concealment of ductwork for the purposes of identifying leakage and recording of the actuating device locations. Prior to occupancy and after substantial completion, pressure difference testing, flow measurements and detection and control verification shall be performed.

1706.2 Qualifications. Testing and inspection agents for smoke control systems shall have expertise in fire protection engineering and mechanical engineering and shall be certified as air balancers.

780 CMR 1707.0 QUALITY ASSURANCE FOR STAIRS AND RAILINGS

1707.1 A quality assurance program for the fabrication and installation of stairs, handrails and guardrails shall be prepared and monitored by the responsible RDP. Anchorage of stair and railing assemblies to structural supports shall be inspected for compliance with contract documents.

780 CMR 1708.0 QUALITY ASSURANCE FOR NON-STRUCTURAL ASSEMBLIES

1708.1 Quality assurance programs shall be prepared and monitored by the responsible RDPs for seismic load resisting connections, supports, and anchorages of the non-structural components, assemblies, and equipment listed below, where such seismic load resisting connections, supports, and anchorages are required elsewhere in 780 CMR:

1. HVAC ductwork containing hazardous materials.
2. Piping systems and mechanical units containing flammable, combustible, or highly toxic chemicals.
3. Electrical equipment used for emergency or standby power systems.
4. Suspended ceiling systems, interior partitions, and access floors.
5. Steel Storage racks.
6. Other mechanical and electrical equipment in buildings in Seismic Performance Category D.

NON-TEXT PAGE

780 CMR 18.00

FOUNDATIONS AND RETAINING WALLS

780 CMR 1801.0 GENERAL

1801.1 Scope. The provisions of 780 CMR 18.00 shall govern the design and construction of foundations and retaining walls.

1801.2 Design. Foundations shall be designed to provide adequate load bearing capacity while limiting settlement, heave and lateral movement to tolerable levels. Allowable bearing pressures, allowable stresses and design formulas provided in 780 CMR 18.00 shall be used with the allowable stress design load combinations specified in 780 CMR 1605.3. The quality and design of structural materials shall conform to the requirements specified in 780 CMR 16.00, 19.00, 21.00, 22.00 and 23.00. Excavations and fills shall also comply with 780 CMR 33.00.

1801.3 Foundation Types Not Covered by Code Provisions. Types of foundations not specifically covered by the provisions of 780 CMR, and ground modification treatments to improve soils with inadequate load bearing capacity or settlement characteristics, may be permitted subject to approval by the building official. A report shall be submitted to the building official that identifies the foundation as a type not covered by existing code provisions, and contains sufficient data and analyses to substantiate the adequacy of the proposed foundation. The report shall be prepared by a registered design professional who is knowledgeable in the design of the proposed type of foundation or ground modification. The building official may require that an independent peer review be performed to evaluate the adequacy of the proposed design.

1801.4 Qualifications of Registered Design Professional. Where the services of a registered design professional are required by the provisions of 780 CMR 18.00, the registered design professional shall be knowledgeable in the field of geotechnical engineering and shall be qualified by appropriate training and experience to provide the specific services required by the code provisions.

780 CMR 1802.0 FOUNDATION AND SOILS INVESTIGATIONS

1802.1 General. Foundation and soils investigations shall be conducted in conformance with 780 CMR 1802.2 through 1802.6. The scope of the investigation shall be determined by a registered design professional. The registered design professional shall oversee the performance of the investigation and prepare a report containing the results of the investigation.

1802.2 Where Required. Foundation and soil investigations shall be required for all new structures, and for alterations of existing structures that result in increased foundation loads or decreased load resistance, except as noted below. Where there is sufficient local experience that indicates satisfactory performance of similar structures in the vicinity of the proposed structure, the following types of structures do not require a foundation and soils investigation, unless specifically required by the building official:

1. one- and two-family dwellings and their accessory buildings;
2. unoccupied structures that do not pose a significant risk to public safety in the event of failure; or
3. structures used for agricultural purposes.

1802.3 Soil and Rock Classification. Classification of soil materials shall be done in accordance with ASTM D 2487. Refer to commentary in 780 CMR 120.R for guidelines regarding determination of soil and rock Material Classes and Consistency in Place for use with Table 1804.3 and related provisions.

1802.4 Investigation. The investigation shall consist of subsurface explorations and engineering studies. The borings, test pits or other subsurface explorations shall be adequate in number and depth and so located to accurately define the nature of the subsurface materials necessary for the support of the structure. When it is proposed to support the structure directly on bedrock, the building official shall require core borings to be made into the rock; or shall require adequate information from other sources to define the nature and quality of the bedrock. The results of previous subsurface explorations may be utilized where deemed to be adequate by the registered design professional. Engineering studies shall be made as necessary to identify suitable bearing strata and evaluate soil strength, compressibility, bearing capacity, settlement, liquefaction potential, lateral earth pressures, slope stability and impacts of groundwater.

1802.4.1 Groundwater Table. The investigation shall determine the location of the groundwater level relative to the proposed structures and evaluate the potential groundwater impacts. The evaluation shall consider both the impacts of groundwater on the structures and the potential impacts of the structures on the local groundwater levels.

1802.4.2 Pile and Pier Foundations. Where pier or pile foundations are used, the investigation shall include the following:

1. Recommended pier or pile types, dimensions and installed capacities.
2. Recommended center-to-center spacing of piles or piers.
3. Driving criteria.
4. Installation procedures.
5. Field inspection and reporting proced-ures (to include procedures for verification of the installed bearing capacity where required).
6. Pier or pile load test requirements.
7. Durability of pier or pile materials.
8. Designation of bearing stratum or strata.
9. Reductions for group action, where necessary.
10. Evaluation of conditions that might promote deterioration of pile or pier foundations, in order to satisfy the requirements of 780 CMR 1808.2.17.

1802.4.3 Rock Foundations. Where sub-surface explorations at the project site indicate variations or doubtful characteristics in the structure of the rock upon which foundations are to be constructed, a sufficient number of borings shall be made to a depth of not less than ten feet below the level of the foundations to provide assurance of the soundness of the foundation stratum and its bearing capacity.

1802.4.4 Liquefaction Potential. Where the foundation investigation indicates subsoils of Material Classes 8 or 9, as defined in Table 1804.3, the investigation shall include an evaluation of the potential for earthquake-induced liquefaction in accordance with 780 CMR 1804.6.

1802.5 Borings, Sampling and Testing. The scope of the subsurface exploration, including the number and types of borings, soundings or test pits, the equipment used to drill and sample, the in-situ testing equipment and the laboratory testing program, shall be determined by a registered design professional. The boring and sampling procedure and apparatus shall be in accordance with generally accepted engineering practice. The registered design professional shall have a qualified representative on the site during the subsurface exploration and shall perform suitable checks to verify the adequacy of information obtained from others.

1802.6 Reports. The design bearing strata and load-bearing capacity shall be shown on the construction document. The written report of the investigation shall include, but need not be limited to, the following information:

1. A plot showing the locations of the subsurface explorations.
2. Logs or other suitable records of the subsurface explorations.
3. An interpretative description of the subsurface profile.
4. Elevation and/or depth of the water table, if encountered, and an evaluation of groundwater impacts in accordance with 780 CMR 1802.4.1.
5. Results of in-situ testing and/or laboratory testing, if performed.
6. Recommendations for foundation type and design criteria.
7. Evaluation of earthquake liquefaction potential
8. Expected total and differential settlement.
9. Pile and pier foundation information in accordance with 780 CMR 1802.4.2
10. Compacted fill material properties and testing in accordance with 780 CMR 1803.5.
11. Lateral earth pressures on foundation walls and retaining walls.

780 CMR 1803.0 EXCAVATION, GRADING AND FILL

1803.1 Excavations near Footings or Foundations. Excavations for any purpose shall not remove vertical or lateral support from any footing or foundation without first underpinning or protecting the footing or foundation against settlement or lateral translation.

1803.2 Placement of Fill Adjacent to Structures. Fill placed adjacent to structures shall be a suitable material placed and compacted in a manner that does not damage the foundation or the waterproofing or damp-proofing material.

1803.3 Site Grading. The ground immediately adjacent to the foundation shall be sloped away from the building at a slope of not less than one unit vertical in 20 units horizontal (5% slope) for a minimum distance of ten feet (3048 mm) measured perpendicular to the face of the wall or an alternate method of diverting water away from the foundation shall be used. The procedure used to establish the final ground level adjacent to the foundation shall account for potential settlement of the backfill.

1803.4 Compacted Structural Fill Material. Where footings or structures will bear on compacted fill material, the compacted fill shall comply with the provisions of the report prepared by a registered design professional in accordance with 780 CMR 1802.6. The report shall contain the following:

1. Specifications for the preparation of the site prior to placement of compacted fill material.
2. Specifications for material to be used as compacted fill.
3. Lateral and vertical limits of the compacted fill.
4. Type and size of compaction equipment and compaction procedures.
5. Maximum allowable thickness of each lift of compacted fill material.

6. Test method to be used to determine the maximum dry density and optimum moisture content of the material to be used as compacted fill.
7. Field test methods for determining the in-place dry density of the compacted fill.
8. Minimum acceptable in-place dry density expressed as a percentage of the maximum dry density determined in accordance with Item 6, and the number and frequency of field tests required to determine compliance with this criterion.
9. Alternative compaction control criteria for materials than cannot be effectively tested by the methods described in 780 CMR 1803.4, Items 6., 7., and 8.

> **Exception:** Compacted fill material less than 12 inches (305 mm) in total thickness does not require a soils investigation report, provided it has been compacted to a minimum of 95% Modified Proctor in accordance with ASTM D 1557. The compaction shall be verified by a qualified inspector approved by the building official.

1803.5 Field Control. The building official will require that a registered design professional or his representative be on the project at all times while fill is being placed and compacted. The representative shall make an accurate record of the types of materials used, including grain-size curves, thickness of lifts, densities, percent compaction, type of compacting equipment and number of coverages, the use of water and other pertinent data.

1803.6 Controlled Low-strength Material (CLSM). Controlled low strength material (CLSM) is defined as a flowable cementitious fill material meeting the requirements of ACI 229R-94 that is placed without compaction. Where footings or structures will bear on CLSM, the CLSM shall comply with the provisions of a report prepared by a registered design professional, which shall contain the following:

1. Specifications for the preparation of the site prior to placement of the CLSM.
2. Specifications for the CLSM.
3. Laboratory or field test method(s) to be used to determine the compressive strength or bearing capacity of the CLSM.
4. Test methods for determining the acceptance of the CLSM in the field.
5. Number and frequency of field tests required to determine compliance with 780 CMR 1803.6, Item 4.

780 CMR 1804.0 ALLOWABLE LOAD-BEARING VALUES

1804.1 Satisfactory Foundation Materials. Foundations for structures shall be supported on natural strata of rock, gravel, sand, inorganic silt, inorganic clay, or combination of these materials provided that they do not overlie an appreciable amount of peat, organic silt, soft clay or other objectionable materials. Compacted fills and CLSM may be used for support of foundations, when designed and monitored by a registered design professional. Other conditions of unsatisfactory bearing materials which are improved in accordance with the recommendations of, and monitored by, a registered design professional, may be accepted by the building official.

1804.2 Protection of Bearing Strata. The bearing strata shall be adequately protected against disturbance. If the bearing materials are disturbed from any cause, for example, by the inward or upward flow of water, by freezing or by construction activities, the extent of the disturbance shall be evaluated by a registered design professional and appropriate remedial measures shall be taken.

1804.3 Presumptive Load Bearing Values. The maximum allowable pressure on the bearing strata supporting spread footings, mats and piers shall not exceed the values specified in Table 1804.3 or the maximum allowable pressure shall be determined by load tests conducted in the field or as otherwise provided herein. Presumptive load-bearing values shall apply to all materials with similar physical characteristics. Where the bearing strata are underlain by weaker materials, the vertical pressure on the underlying materials shall be checked in accordance with 780 CMR 1804.7. Higher allowable bearing pressures may used if substantiated by the results of investigations, analyses or testing prepared by a registered design professional and approved by the building official.

> **1804.3.1 Net Bearing Pressure**. For the purposes of 780 CMR 1804.3, the applied bearing pressure shall be the net bearing pressure computed using the allowable stress design load combinations specified in 780 CMR 1605.3, including the weight of the foundation and of any immediately overlying material, minus the pressure applied by the column of soil, including the water in its voids, that extends from the lowest immediately adjacent surface of the soil to the bottom of the footing, pier or mat.
>
> **1804.3.2 Classification of Bearing Materials.** The terms used in 780 CMR 1804 shall be interpreted in accordance with generally accepted engineering nomenclature. Refer to commentary in 780 CMR 120.R for guidelines regarding soil and rock classification and description.
>
> **1804.3.3 Compacted Fill.** Materials from Classes 6 through 8, Table 1804.3, or dense graded crushed stone, which contain no plastic fines, shall have a maximum allowable bearing pressure of up to five tons per square foot when compacted to 95% or greater of the maximum dry density as determined by ASTM D1557 listed in.

For compacted fills which do not meet the above criteria or materials which cannot be tested as above, a registered design professional shall be engaged to provide recommendations for compaction and maximum allowable design bearing pressures.

TABLE 1804.3 ALLOWABLE BEARING PRESSURES FOR FOUNDATION MATERIALS

Material Class	Description	Notes	Consistency in Place[1]	Allowable Net Bearing Pressure (tons/ft^2)
1a	Massive bedrock: Granite, diorite gabbro, basalt, gneiss	3	Hard, sound rock, minor jointing	100
1b	Quartzite, well cemented conglomerate	3	Hard, sound rock moderate jointing	60
2	Foliated bedrock: slate, schist	3	Medium hard rock, minor jointing	40
3	Sedimentary bedrock: cementation shale, siltstone, sandstone, limestone, dolomite, conglomerate	3, 4	Soft rock, moderate jointing	20
4	Weakly cemented sedimentary bedrock: compaction shale or other similar rock in sound condition	3	Very soft rock	10
5	Weathered bedrock: any of the above except shale.	3, 5	Very soft rock, weathered and/or major jointing and fracturing	8
6	Slightly cemented sand and/or gravel, glacial till (basal or lodgment), hardpan	7,8	Very dense	10
7	Gravel, widely graded sand and gravel; and granular ablation till	6, 7, 8	Very dense Dense Medium dense Loose Very loose	8 6 4 2 Note 11
8	Sands and non-plastic silty sands with little or no gravel (except for Class 9 materials)	6, 7, 8, 9	Dense Medium dense Loose Very loose	4 3 1 Note 11
9	Fine sand, silty fine sand, and non-plastic inorganic silt	6, 7, 9	Dense Medium dense Loose Very loose	3 2 1 Note 11
10	Inorganic sandy or silty clay, clayey sand, clayey silt, clay, or varved clay; low to high plasticity	5, 6, 10	Hard Stiff Medium Soft	4 2 1 Note 11
11	Organic soils: peat, organic silt, organic clay	11		Note 11

Notes for Table 1804.3:

1. Refer to commentary in 780 CMR 120.R regarding typical index test values that may be helpful as guides for evaluation of consistency in place.
2. Refer to 780 CMR 1804.3.1 for the definition of net bearing pressure.
3. The allowable bearing pressures may be increased by an amount equal to 10% for each foot of depth below the surface of sound rock; however, the increase shall not exceed two times the value given in the table.
4. For limestone and dolomite, the bearing pressures given are acceptable only if an exploration program performed under the direction of a registered design professional demonstrates that there are no cavities within the zone of influence of the foundations. If cavities exist, a special study of the foundation conditions is required.
5. Weathered shale and/or weathered compaction shale shall be included in Material Class 10. Other highly weathered rocks and/or residual soils shall be treated as soil under the appropriate description in Material Classes 6 to 10. Where the transition between residual soil and bedrock is gradual, a registered design professional shall make a judgment as to the appropriate bearing pressure.

6. Settlement analyses in accordance with 780 CMR 1804.8 should be performed if the ability of a given structure to tolerate settlements is in question, particularly for, but not limited to, soft or very soft clays and silts and loose granular materials.
7. Allowable bearing pressures may be increased by an amount equal to 5% for each foot of depth of the bearing area below the minimum required in 780 CMR 1805.2; however, the bearing pressure shall not exceed two times the value given in the table. For foundation bearing areas having a least lateral dimension smaller than three feet, the allowable bearing pressure shall be ⅓ of the tabulated value times the least dimension in feet.
8. Refer to 780 CMR 1804.3.3 when these materials are used as compacted fills.
9. These materials are subject to the provisions in 780 CMR 1804.6 (Liquefaction).
10. Alternatively, the allowable bearing pressure may be taken as 1.5 times the peak unconfined compressive strength of undisturbed samples for square and round footings or 1.25 times that strength for footings with length to width ratio of four or greater. For intermediate cases, interpolation may be used.
11. A registered design professional shall be engaged to provide recommendations for these special cases. Direct bearing on organic soils is not permitted. Organic soils are allowed under foundations for those cases defined in 780 CMR 1804.4.2 (Preloaded materials).

1804.4 Lightweight Structures. One-story structures without masonry walls and not exceeding 800 square feet in area may be founded on a layer of satisfactory bearing material not less than three feet (1 m) thick, which is underlain by highly compressible material, provided that the stresses induced in the unsatisfactory material by the live and dead loads of the structure, and the weight of any new fill within or adjacent to the building area, will not exceed 250 pounds per square foot (12 Kpa).

1804.4.1 Bearing Capacity for Lightweight Structures. Lightweight structures and accessory structures, such as garages and sheds, may be founded on normally unacceptable bearing strata, provided such material is determined by a registered design professional as being satisfactory for the intended use.

1804.4.2 Preloaded Materials. The building official may allow the use of certain otherwise unsatisfactory natural soils and uncompacted fills for support of one-story structures after these materials have been preloaded to effective stresses not less than 150% of the effective stresses which will be induced by the live and dead loads of the structure and any additional fill materials. The preloading shall be conducted under the direction of a registered design professional who shall submit a report documenting that adequate consolidation of the material was achieved prior to removal of the preload.

1804.5 Dynamic Loading. For load combinations that include short duration dynamic loading, the allowable load bearing value of foundations may be increased based on consideration of both the duration of the loading and the dynamic properties of the soil if substantiated by the results of investigations, analyses or testing prepared by a registered design professional and approved by the building official.

1804.6 Liquefaction.

1. The potential for liquefaction induced by the design earthquake in saturated clean to silty medium to fine sands (Soil Classes 8 and 9 in Table 1804.3) shall be evaluated on the basis of Figures 1804.6(a) through (c) for cases where lateral sliding cannot occur. Figure 1804.6(a) shall be used if the Standard Penetration Test blowcounts, N (blows per foot), were determined using the standard 140-pound donut drop weight, or if the type of hammer is not known. Figures 1804.6(b) and (c) shall be used only for cases where the specific type of hammer (safety hammer or automatic hammer) is known to have been used. Figures 1804.6(b) and (c) reflect the greater energy efficiency with these two specific types of hammers. Hammer type shall be as described in ASTM Standard Method D6066. N-values to be used in these figures are uncorrected field values.
2. Figures 1804.6(a) through (c) are intended to be used as a screening tool for Site Classes A through D, and are based on a rock spectral rock acceleration, $S_{D1} = 0.077$, a soil amplification factor, Fv = 2.4 for Site Class D and a factor of safety of 1.1.
3. If the standard penetration resistances, N, in all strata of medium to fine sand lie above the applicable curve in Figure 1804.6(a) through (c), the sands at the site shall be considered not susceptible to liquefaction. Liquefaction below a depth of 60 ft (18m) from final grade need not be considered for level ground. For pressure-injected footings, the ten-foot (3m) thickness of soil immediately below the bottom of the driven shaft shall be considered not susceptible to liquefaction.
4. Compacted granular fills shall be considered not susceptible to liquefaction provided they are systematically compacted to at least 93% of the maximum dry density determined in accordance with ASTM Standard Method D1557, or to a relative density of at least 60% in the case of granular soils having less than 10% by weight material passing the No. 200 U.S. sieve.
5. Soils identified in 780 CMR 1804.6.1 that do not meet the criteria in 780 CMR 1804.6.3 and

1804.6.4 shall be considered susceptible to liquefaction. Appropriate studies, analyses and designs shall be made by a registered design professional to determine that the structural loads can be safely supported. Such studies, analyses and designs might include the following:

a. Investigations to establish that the soils at the site are not subject to liquefaction during the design earthquake, or

b. Design of foundations that will not fail either by loss of bearing capacity or excessive settlement or lateral deflection if liquefaction occurs, or

c. Replacement or densification of the potentially liquefiable soils such that liquefaction will not occur.

6. For sites underlain by saturated sands where lateral sliding (slope instability) may occur, studies by the registered design professional shall be made to establish the safety against sliding during the design earthquake.

7. For sites underlain by saturated silty sands and inorganic non-plastic silts, with standard penetration resistances, N, lying below (to the left of) the appropriate curve in Figure 1804.6(a) through (c), studies shall be made by the registered design professional to determine the susceptibility to liquefaction of these soils.

FIGURE 1804.6(A) LIQUEFACTION SUSCEPTIBILITY - DONUT HAMMER BLOW COUNTS

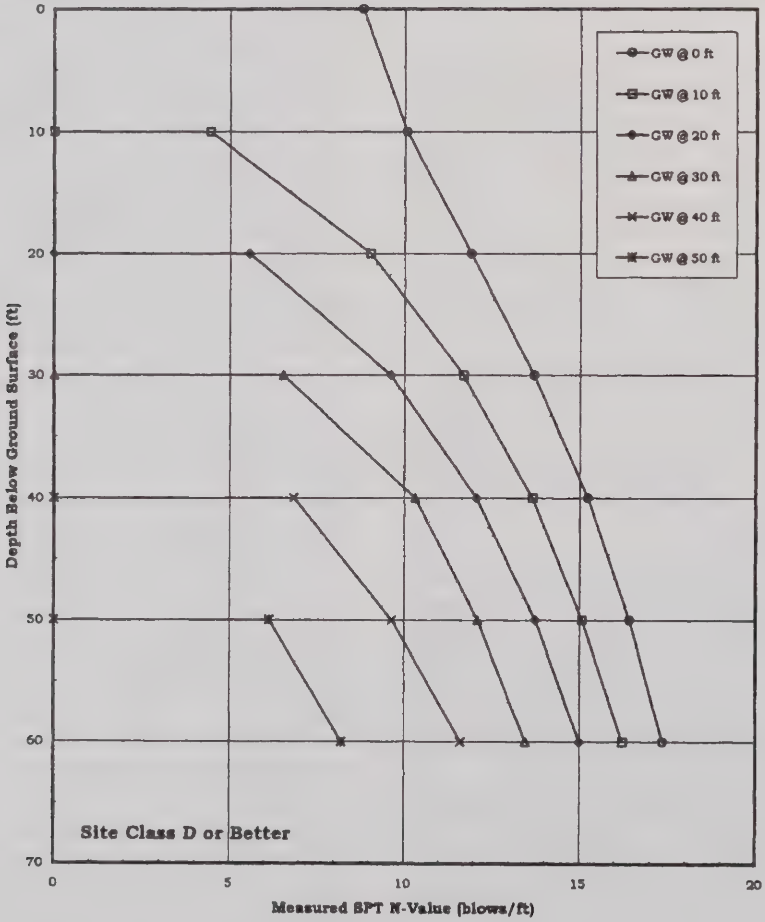


FIGURE 1804.6(B) LIQUEFACTION SUSCEPTIBILITY - SAFETY HAMMER BLOW COUNTS

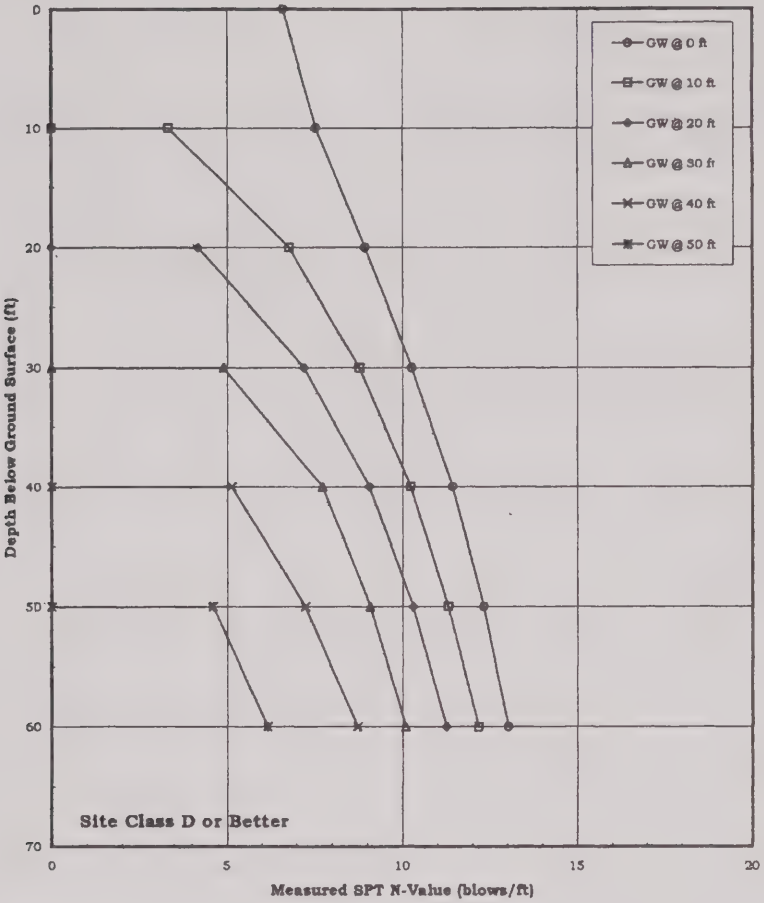
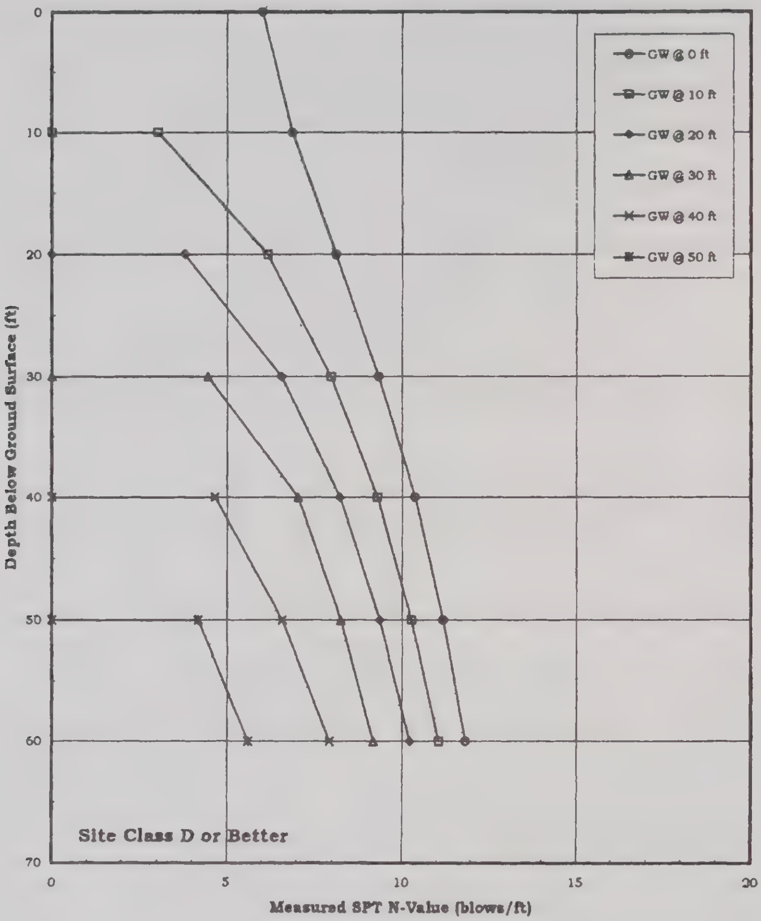


FIGURE 1804.6(C) LIQUEFACTION SUSCEPTIBILITY - AUTOMATIC HAMMER BLOW COUNTS



1804.7 Vertical Pressure. The computed vertical pressure at any level beneath a foundation shall not exceed the allowable bearing pressure for the material at that level. Computation of the vertical pressure in the bearing materials at any depth below a foundation shall be made on the assumption that the load is spread uniformly at an angle of 30 degrees with the vertical, or another suitable method. Interaction of adjacent foundations shall be considered in computation of the vertical pressure.

1804.8 Settlement Analysis. Whenever a structure is to be supported by medium or soft clay (materials of Class 10) or other materials which may be subject to settlement or consolidation, the settlements of the structure and of neighboring structures due to consolidation shall be given careful consideration, particularly if the subsurface material or the loading is subject to significant variation. The effects of fill loads within the building area or fill and other loads adjacent to the building shall be included in the settlement analysis.

1804.9 Lateral Loads on Foundations. Where foundations are required to resist lateral loads, the allowable values of sliding friction, adhesion and passive pressure for design shall be determined by a registered design professional.

780 CMR 1805.0 FOOTINGS AND MAT FOUNDATIONS

1805.1 General. Footings and mat foundations shall be designed and constructed in accordance with 780 CMR 1805.1 through 1805.12. Footings and mat foundations shall be supported on undisturbed natural soil, compacted fill, CLSM or bedrock in accordance with 780 CMR 1804.0. Compacted fill material shall be placed in accordance with 780 CMR 1803.4 and CLSM shall be placed in accordance with 780 CMR 1803.6.

1805.2 Minimum Depth. The bottom surface of any foundation bearing on material other than sound bedrock shall be at least 18 inches (460 mm) below the adjacent ground surface or the top surface of a floor slab bearing directly on the soil immediately adjacent to the foundation.

1805.3 Slope of Bearing Surface. Where the slope of the bearing surface exceeds one vertical in ten horizontal, the bottom surface of the foundation shall be stepped to prevent lateral sliding along the bearing surface, unless sufficient resistance against sliding is provided by other means.

1805.4 Frost Protection. All foundations for buildings and structures shall extend to a minimum of four feet (1.2m) below finished grade, unless:

1. Frost protection is provided in accordance with ASCE-32;
2. The foundation bears on sound bedrock; or
3. The bearing materials below the foundation, to a depth of four feet below finished grade, are not susceptible to frost heave.

Where the foundation grade is established at a depth of less than four feet below finished grade, appropriate supporting data prepared by a registered design professional shall be submitted to the building official to substantiate the design foundation grade.

Exception. Frost protection is not required for free-standing buildings meeting all of the following requirements:

1. Classified in Importance Category I (see Table 1604.5);
2. Area of 400 square feet (37 m2) or less; and
3. Eave height of ten feet (3.1 m) or less.

1805.5 Isolated Footings. Footings on granular soil of Classes 7, 8 and 9 of Table 1804.3 and compacted fill shall be so located that the line drawn between the lower edges of adjoining footings shall not have a steeper slope than 30 degrees (0.52 rad) with the horizontal unless the material supporting the higher footing is braced or retained or otherwise laterally supported in an approved manner or a greater slope has been established by a registered design professional.

1805.6 Foundations on or Adjacent to Slopes. Where buildings and structures are located on or adjacent to slopes the following impacts shall be addressed in the design. Foundations located on a slope, or near the top edge of a slope, shall have sufficient embedment depth below the slope surface and/or setback from the edge of the slope to prevent slope stability failure or detrimental settlement due to the presence of the slope. Buildings and structures located near the bottom of a slope shall be setback a sufficient distance from the slope to provide protection from slope drainage, erosion, slope failure and falling debris.

1805.7 Design. Foundations shall be designed so as not to exceed the allowable bearing pressure determined in accordance with 780 CMR 1804.3. The minimum width of the foundations shall not be less than 12 inches (305 mm). Footings shall be designed and constructed in accordance with 780 CMR 1805.8 through 1805.12.

1805.7.1 Vibratory Loads. Where machinery operations or other vibrations are transmitted through the foundation, consideration shall be given in the foundation design to prevent detrimental disturbance of the soil.

1805.7.2 Eccentric Loads. Where foundations are subject to eccentric loadings, the maximum pressure on the basis of straight-line distribution shall not exceed the allowable bearing pressure.

1805.8 Concrete Footings. The design, materials and construction of concrete footings shall comply with 780 CMR 1805.8.1 through 1805.8.6 and the provisions of 780 CMR 19.

1805.8.1 Concrete Strength. Concrete in footings shall have a specified compressive strength (f'_c) of not less than 2,500 psi (17.2 MPa) at 28 days.

1805.8.2 Plain Concrete Footings. The edge thickness of plain concrete footings supporting walls of other than light-frame construction shall not be less than eight inches (203 mm) where placed on soil.

Exception. For plain concrete footings supporting Group R-3 occupancies and buildings less than two stories in height of light- frame construction, the edge thickness is permitted to be six inches (152 mm), provided that the footing does not extend beyond a distance greater than the thickness of the footing on either side of the supported wall.

1805.8.3 Placement of Concrete. Concrete footings shall not be placed through water unless a tremie or other method approved by the building official is used. Where placed under or in the presence of water, the concrete shall be deposited by approved means to ensure minimum segregation of the mix and negligible turbulence of the water.

1805.8.4 Protection of Concrete. Concrete footings shall be protected from freezing during depositing and for a period of not less than 5 days thereafter. Water shall not be allowed to flow through the deposited concrete.

1805.8.5 Forming of Concrete. Concrete footings are permitted to be cast against the earth where, in the opinion of the building official, soil conditions do not require forming. Where forming is required, forming shall be in accordance with Chapter 6 of ACI 318.

1805.9 Masonry-unit Footings. The design, materials and construction of masonry-unit footings shall comply with 780 CMR 1805.9.1 and 1805.9.2, and the provisions of 780 CMR 21.00.

1805.9.1 Dimensions. Masonry-unit footings shall be laid in Type M or S mortar complying with 780 CMR 2103.7 and the depth shall not be less than twice the projection beyond the wall, pier or column. The width shall not be less than eight inches (203 mm) wider than the wall supported thereon.

1805.9.2 Offsets. The maximum offset of each course in brick foundation walls stepped up from the footings shall be 1½ inches (38 mm) where laid in single courses, and three inches (76 mm) where laid in double courses.

1805.10 Steel Grillage Footings. Grillage footings of structural steel shapes shall be separated with approved steel spacers and shall be entirely encased in concrete with at least six inches (152 mm) on the bottom and at least four inches (102 mm) at all other points. The spaces between the shapes shall be completely filled with concrete or cement grout.

1805.11 Timber Footings. Timber footings are permitted for buildings of Type V construction and as otherwise approved by the building official. Such footings shall be treated in accordance with AWPA C2 or C3. Treated timbers are not required where placed entirely below permanent water level, or where used as capping for wood piles that project above the water level over submerged or marsh lands. The compressive stresses perpendicular to grain in untreated timber footings supported upon piles shall not exceed 70% of the allowable stresses for the species and grade of timber as specified in the AFPA NDS.

1805.12 Wood Foundations. Wood foundation systems shall be designed and installed in accordance with AFPA Technical Report No. 7. Lumber and plywood shall be treated in accordance with AWPA C22 and shall be identified in accordance with 780 CMR 2303.1.8.1.

1805.13 Seismic Requirements. See 780 CMR 1910.0 for additional requirements for footings and foundations of structures assigned to Seismic Design Categories C and D. For structures assigned to Seismic Design Categories D, provisions of ACI 318, Sections 21.8.1 to 21.8.3, shall apply when not in conflict with the provisions of 780 CMR 1805.0. Concrete shall have a specified compressive strength of not less than 3,000 psi (20.68 MPa) at 28 days.

> **Exception**. Group R or Group U Occupancies of light-frame construction and two stories or less in height are permitted to use concrete with a specified compressive strength of not less than 2,500 psi (17.2 MPa) at 28 days.

1805.14 Footing Seismic Ties. Where a structure is assigned to Seismic Design Category D in accordance with 780 CMR 1616, individual spread footings founded on soil defined in 780 CMR 1615.1.1 as Site Class E or F shall be interconnected by ties. Ties shall be capable of carrying, in tension or compression, a force equal to the product of the larger footing load times the seismic coefficient S_{DS} divided by ten unless it is demonstrated that equivalent restraint is provided by reinforced concrete beams within slabs on grade or reinforced concrete slabs on grade, by the lateral confinement provided by competent soil or rock surrounding the footing or by other approved means.

780 CMR 1806.0 FOUNDATION WALLS AND RETAINING WALLS

1806.1 Definitions. The following definitions shall apply for the purposes of 780 CMR 1806.

FOUNDATION WALL. A wall extending partially or fully below grade, that supports vertical loads from walls, piers, columns or other structural elements of a building or other structure, and may also support unbalanced lateral loads from soil, water or other materials adjacent to the wall.

RETAINING WALL. A wall or other retaining structure or system designed to provide lateral support of soil, water or other materials, that does not provide vertical support for structural elements of a building and has any portion of its exposed face inclined steeper than one horizontal to one vertical. This definition shall include concrete walls, crib and bin walls, reinforced or mechanically stabilized earth systems, anchored walls, soil nail walls, multi-tiered systems, boulder walls, or other retaining structures.

> **Exception**. The definition of Retaining Wall does not include slope facings, armor or riprap placed for the sole purpose of protection against surface erosion.

1806.2 Design Earth Pressures. The design earth pressures for foundation walls and retaining walls shall be determined by a registered design professional based on the data and recommendations provided in the foundation and soils investigation report prepared in accordance with 780 CMR 1802. The design earth pressures shall account for the following factors:

1. The nature of the native soil and backfill material
2. Drainage provisions and potential hydrostatic pressures
3. The rigidity of the wall and its supports
4. Pressures due to compaction of backfill material
5. Pressures due to surcharge loadings
6. Seismic earth pressures

1806.3 Foundation Wall Design. Concrete and masonry foundation walls shall be designed in accordance with 780 CMR 1806.0 and 780 CMR 19.00 or 21.00. Foundation walls for single level basements that are within the parameters of Tables 1806.3(1) through 1806.3(4) may be designed and constructed in accordance with 780 CMR 1806.3.1 through 1806.3.5, if they meet the following criteria:

1. The wall is laterally supported at the top and bottom
2. There is no net hydrostatic pressure on the wall
3. There are no surcharge loadings
4. The backfill adjacent to the wall is not subjected to heavy compaction loads

1806.3.1 Foundation Wall Thickness. The minimum thickness of concrete and masonry foundation walls shall comply with 780 CMR 1806.3.1.1 through 1806.3.1.3.

1806.3.1.1 Thickness Based on Walls Supported. The thickness of foundation walls shall not be less than the thickness of the wall supported, except that foundation walls of at least eight-inch (203 mm) nominal width are permitted to support brick-veneered frame walls and ten-inch-wide (254 mm) cavity walls provided the requirements of 780 CMR 1806.3.1.2 are met. Corbeling of masonry shall be in accordance with 780 CMR 2104.2. Where an eight-inch (203 mm) wall is corbeled, the top corbel shall be a full course of headers at least six inches (152 mm) in length, extending not higher than the bottom of the floor framing.

TABLE 1806.3(1) PLAIN MASONRY AND PLAIN CONCRETE FOUNDATION WALLS[a, b, c]

PLAIN MASONRY				
WALL HEIGHT (feet)	HEIGHT OF UNBALANCED BACKFILL (feet)	MINIMUM NOMINAL WALL THICKNESS (inches)		
		Soil classes and lateral soil load[a] (psf per foot below natural grade)		
		GW, GP, SW and SP soils 30	GM, GC, SM, SM-SC and ML soils 45	SC, MH, ML-CL and Inorganic CL soils 60
7	4 (or less)	8	8	8
	5	8	10	10
	6	10	12	10 (solid[c])
	7	12	10 (solid[c])	10 (solid[c])
8	4 (or less)	8	8	8
	5	8	10	12
	6	10	12	12 (solid[c])
	7	12	12 (solid[c])	Note d
	8	10 (solid[c])	12 (solid[c])	Note d
9	4 (or less)	8	8	8
	5	8	10	12
	6	12	12	12 (solid[c])
	7	12 (solid[c])	12 (solid[c])	Note d
	8	12 (solid[c])	Note d	Note d
	9	Note d	Note d	Note d
PLAIN CONCRETE				
WALL HEIGHT (feet)	HEIGHT OF UNBALANCED BACKFILL (feet)	MINIMUM NOMINAL WALL THICKNESS (inches)		
		Soil classes and lateral soil load[a] (psf per foot below natural grade)		
		GW, GP, SW and SP soils 30	GM, GC, SM, SM-SC and ML soils 45	SC, MH, ML-CL and Inorganic CL soils 60
7	4 (or less)	7½	7½	7½
	5	7½	7½	7½
	6	7½	7½	8
	7	7½	8	10
8	4 (or less)	7½	7½	7½
	5	7½	7½	7½
	6	7½	7½	10
	7	7½	10	10
	8	10	10	12
9	4 (or less)	7½	7½	7½
	5	7½	7½	7½
	6	7½	7½	10
	7	7½	10	10
	8	10	10	12
	9	10	12	Note e

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot per foot = 0.157 kPa/m.

a. For design lateral soil loads, see 780 CMR 1610. Soil classes are in accordance with the Unified Soil Classification System and design lateral soil loads are for moist soil conditions without hydrostatic pressure.

b. Provisions for table 1806.3(1) are based on construction requirements specified in 780 CMR 1805.5.2.

c. Solid grouted hollow units or solid masonry units.

d. A design in compliance with 780 CMR 21.00 or reinforcement in accordance with Table 1805.5(2) is required.

e. A design in compliance with 780 CMR 19.00 is required.

TABLE 1806.3(2) 8-INCH CONCRETE AND MASONRY FOUNDATION WALLS WITH REINFORCING WHERE $d \geq 5$ INCHES[a, b, c]

WALL HEIGHT (feet)	HEIGHT OF UNBALANCED BACKFILL (feet)	VERTICAL REINFORCEMENT		
		Soil classes and lateral soil load[a] (psf per foot below natural grade)		
		GW, GP, SW and SP soils 30	GM, GC, SM, SM-SC and ML soils 45	SC, MH, ML-CL and Inorganic CL soils 60
7	4 (or less)	#4 at 48" o.c.	#4 at 48" o.c.	#4 at 48" o.c.
	5	#4 at 48" o.c.	#4 at 48" o.c.	#4 at 40" o.c.
	6	#4 at 48" o.c.	#5 at 48" o.c.	#5 at 40" o.c.
	7	#4 at 40" o c.	#5 at 40" o.c.	#6 at 48" o.c.
8	4 (or less)	#4 at 48" o.c.	#4 at 48" o.c.	#4 at 48" o.c.
	5	#4 at 48" o.c.	#4 at 48" o.c	#4 at 40" o.c.
	6	#4 at 48" o.c.	#5 at 48" o.c.	#5 at 40" o c.
	7	#5 at 48" o.c.	#6 at 48" o.c.	#6 at 40" o.c.
	8	#5 at 40" o.c.	#6 at 40" o.c.	#7 at 40" o.c.
9	4 (or less)	#4 at 48" o.c.	#4 at 48" o.c.	#4 at 48" o.c.
	5	#4 at 48" o.c.	#4 at 48" o.c.	#5 at 48" o.c.
	6	#4 at 48" o.c.	#5 at 48" o.c.	#6 at 48" o.c.
	7	#5 at 48" o c.	#6 at 48" o.c.	#7 at 48" o.c.
	8	#5 at 40" o.c.	#7 at 48" o.c.	#8 at 48" o.c.
	9	#6 at 40" o.c.	#8 at 48" o c.	#8 at 32" o.c.

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot per foot = 0.157 kPa/m.

a. For design lateral soil loads, see 780 CMR 1610. Soil classes are in accordance with the Unified Soil Classification System and design lateral soil loads are for moist soil conditions without hydrostatic pressure.

b. Provisions for table1806.3(2) are based on construction requirements specified in 780 CMR 1805.5.2.

c. For alternative reinforcement, see 780 CMR 1805.5.3.

TABLE 1806.3(3) 10-INCH CONCRETE AND MASONRY FOUNDATION WALLS WITH REINFORCING WHERE $d \geq 6.75$ INCHES[a, b, c]

WALL HEIGHT (feet)	HEIGHT OF UNBALANCED BACKFILL (feet)	VERTICAL REINFORCEMENT		
		Soil classes and lateral soil load[a] (psf per foot below natural grade)		
		GW, GP, SW and SP soils 30	GM, GC, SM, SM-SC and ML soils 45	SC, MH, ML-CL and Inorganic CL soils 60
7	4 (or less)	#4 at 56" o c	#4 at 56" o.c.	#4 at 56" o.c.
	5	#4 at 56" o.c.	#4 at 56" o.c.	#4 at 56" o.c.
	6	#4 at 56" o.c.	#4 at 48" o.c.	#4 at 40" o.c.
	7	#4 at 56" o.c.	#5 at 56" o.c.	#5 at 40" o.c.
8	4 (or less)	#4 at 56" o.c.	#4 at 56" o.c.	#4 at 56" o.c.
	5	#4 at 56" o.c.	#4 at 56" o.c.	#4 at 48" o.c.
	6	#4 at 56" o.c.	#4 at 48" o.c.	#5 at 56" o.c.
	7	#4 at 48" o.c.	#4 at 32" o.c.	#6 at 56" o.c.
	8	#5 at 56" o.c.	#5 at 40" o.c.	#7 at 56" o.c.
9	4 (or less)	#4 at 56" o.c.	#4 at 56" o.c.	#4 at 56" o.c.
	5	#4 at 56" o.c.	#4 at 56" o.c.	#4 at 48" o.c.
	6	#4 at 56" o.c	#4 at 40" o.c.	#4 at 32" o.c.
	7	#4 at 40" o.c.	#5 at 48" o.c	#6 at 48" o.c.
	8	#4 at 32" o.c.	#6 at 48" o.c.	#4 at 16" o.c.
	9	#5 at 40" o.c.	#6 at 40" o.c.	#7 at 40" o.c.

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot per foot = 0.157 kPa/m.

a. For design lateral soil loads, see 780 CMR 1610. Soil classes are in accordance with the Unified Soil Classification System and design lateral soil loads are for moist soil conditions without hydrostatic pressure.

b. Provisions for table1806.3(3) are based on construction requirements specified in 780 CMR 1805.5.2.

c. For alternative reinforcement, see 780 CMR 1805.5.3.

TABLE 1806.3(4) 12-INCH CONCRETE AND MASONRY FOUNDATION WALLS WITH REINFORCING WHERE *d* ≥ 8.75 INCHES[a, b, c]

WALL HEIGHT (feet)	HEIGHT OF UNBALANCED BACKFILL (feet)	VERTICAL REINFORCEMENT		
		Soil classes and lateral soil load[a] (psf per foot below natural grade)		
		GW, GP, SW and SP soils 30	GM, GC, SM, SM-SC and ML soils 45	SC, MH, ML-CL and Inorganic CL soils 60
7	4 (or less)	#4 at 72" o.c.	#4 at 72" o.c.	#4 at 72" o.c.
	5	#4 at 72" o.c.	#4 at 72" o.c	#4 at 72" o.c.
	6	#4 at 72" o.c.	#4 at 64" o.c	#4 at 48" o.c.
	7	#4 at 72" o.c.	#4 at 48" o.c.	#5 at 56" o.c.
8	4 (or less)	#4 at 72" o.c.	#4 at 72" o.c.	#4 at 72" o.c.
	5	#4 at 72" o.c.	#4 at 72" o.c.	#4 at 72" o.c.
	6	#4 at 72" o.c.	#4 at 56" o.c.	#5 at 72" o.c.
	7	#4 at 64" o c.	#5 at 64" o.c	#4 at 32" o.c.
	8	#4 at 48" o.c.	#4 at 32" o.c.	#5 at 40" o.c.
9	4 (or less)	#4 at 72" o.c.	#4 at 72" o.c	#4 at 72" o.c.
	5	#4 at 72" o.c.	#4 at 72" o.c.	#4 at 64" o.c.
	6	#4 at 72" o.c	#4 at 56" o.c.	#5 at 64" o.c.
	7	#4 at 56" o.c.	#4 at 40" o.c.	#6 at 64" o.c
	8	#4 at 64" o.c.	#6 at 64" o.c.	#6 at 48" o.c.
	9	#5 at 56" o.c.	#7 at 72" o.c.	#6 at 40" o.c.

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot per foot = 0.157 kPa/m.

a. For design lateral soil loads, see 780 CMR 1610. Soil classes are in accordance with the Unified Soil Classification System and design lateral soil loads are for moist soil conditions without hydrostatic pressure.

b. Provisions for table1806.3(3) are based on construction requirements specified in 780 CMR 1805.5.2.

c. For alternative reinforcement, see 780 CMR 1805.5.3.

1806.3.1.2 Thickness Based on Soil Loads, Unbalanced Backfill Height and Wall Height. The thickness of foundation walls shall comply with the requirements of Table 1806.3(1) for plain masonry and plain concrete walls or Table 1806.3(2), 1806.3(3) or 1806.3(4) for reinforced concrete and masonry walls. When using the tables, masonry shall be laid in running bond and the mortar shall be Type M or S.

Unbalanced backfill height is the difference in height of the exterior and interior finish ground levels. Where an interior concrete slab is provided, the unbalanced backfill height shall be measured from the exterior finish ground level to the top of the interior concrete slab.

1806.3.1.3 Rubble Stone. Foundation walls of rough or random rubble stone shall not be less than 16 inches (406 mm) thick. Rubble stone shall not be used for foundations for structures in Seismic Design Category C and D.

1806.3.2 Foundation Wall Materials. Foundation walls constructed in accordance with Tables 1806.3(1), 1806.3(2), 1806.3(3) or 1806.3(4) shall comply with the following:

1. Vertical reinforcement shall have a minimum yield strength of 60,000 psi (414 MPa).
2. The specified location of the reinforcement shall equal or exceed the effective depth distance, *d*, noted in Tables 1806.3(2), 1806.3(3) and 1806.3(4) and shall be measured from the face of the soil side of the wall to the center of vertical reinforcement. The reinforcement shall be placed within the tolerances specified in ACI 530.1/ASCE 6/TMS 402, Article 3.4 B7 of the specified location.
3. Concrete shall have a specified compressive strength of not less than 2,500 psi (17.2 MPa) at 28 days.
4. Grout shall have a specified compressive strength of not less than 2,000 psi (13.8 MPa) at 28 days.
5. Hollow masonry units shall comply with ASTM C 90 and shall be installed with Type M or S mortar.

1806.3.3 Alternative Foundation Wall Reinforcement. In lieu of the reinforcement provisions in Table 1806.3(2), 1806.3(3) or 1806.3(4), alternative reinforcing bar sizes and spacings having an equivalent cross-sectional area of reinforcement per linear foot (mm) of wall are permitted to be used, provided the spacing of reinforcement does not exceed 72 inches (1829 mm) and reinforcing bar sizes do not exceed No. 11.

1806.3.4 Hollow Masonry Walls. At least 4 inches (102 mm) of solid masonry shall be provided at girder supports at the top of hollow masonry unit foundation walls.

1806.3.5 Seismic Requirements. Tables 1806.3(1) through 1806.3(4) shall be subject to the following limitations in 780 CMR 1806.3.5.1 and 1806.3.5.2 based on the seismic design category assigned to the structure as defined in 780 CMR 1616.0.

1806.3.5.1 Seismic Requirements for Concrete Foundation Walls. Concrete foundation walls designed using Tables 1806.3(1) through 1806.3(4) shall be subject to the following limitations:

1. Seismic Design Categories A and B. No limitations, except provide not less than two No. 5 bars around window and door openings. Such bars shall extend at least 24 inches (610 mm) beyond the corners of the openings.
2. Seismic Design Category C. Tables shall not be used except as allowed for plain concrete members in 780 CMR 1910.4.
3. Seismic Design Category D. Tables shall not be used except as allowed for plain concrete members in ACI 318, Section 22.10.

1806.3.5.2 Seismic Requirements for Masonry Foundation Walls. Masonry foundation walls designed using Tables 1806.3(1) through 1806.3(4) shall be subject to the following limitations:

1. Seismic Design Categories A and B. No additional seismic requirements.
2. Seismic Design Category C. A design using Tables 1806.3(1) through 1806.3(4) subject to the seismic requirements of 780 CMR 2106.4.
3. Seismic Design Category D. A design using Tables 1806.3(2) through 1806.3(4) subject to the seismic requirements of 780 CMR 2106.5.

1806.4 Retaining Wall Design. Retaining walls shall be designed to resist the static and seismic pressures of the retained materials, water pressures, and dead and live load surcharges to which such walls are subjected, and to ensure stability against excessive movements, overturning, sliding, excessive foundation pressure and water uplift. The structural design of retaining walls shall conform to the requirements of 780 CMR 16, 19, 21, 22 and 23. Retaining walls that support an unbalanced height of retained material greater than six feet (1.83 m), and any retaining system or slope that could impact public safety or the stability of an adjacent structure, shall be designed by a registered design professional.

1806.4.1 Overturning and Sliding Stability. Retaining walls shall be designed for a minimum safety factor of 1.5 against overturning and lateral sliding for static loading conditions.

1806.4.2 Overall Stability. The overall, global stability of a retaining wall, considering potential failure surfaces extending through the materials located below, in front of and behind the wall, shall be evaluated.

1806.4.3 Discrete Elements. For retaining walls constructed of discrete elements, such as unmortared masonry, rock, boulders or stacked modular units, the elements shall be bonded or fastened together to prevent dislodgment under static and seismic loading conditions where dislodgment of the elements could pose a risk to public safety.

1806.4.4 Coping. All masonry retaining walls, other than reinforced concrete walls, shall be protected with an approved coping.

1806.4.5 Guards. Where retaining walls with differences in grade level on either side of the wall in excess of four feet (1.2 m) are located closer than two feet (0.6 m) to a walk, path, parking lot or driveway on the high side, such retaining walls shall be provided with guards or other approved protective measures.

1806.5 Wall Drainage. Foundation walls and retaining walls shall be designed to support a hydrostatic head of water pressure equal to the full height of the wall, unless a drainage system is installed in accordance with 780 CMR 1807.4.2 and 1807.4.3. Where a drainage system is provided to reduce or eliminate the design hydrostatic pressure on the wall, it shall be designed with sufficient permeability and discharge capacity to permanently prevent hydrostatic pressure on the wall, and shall be provided with appropriate filters and other design features to prevent blockage due to siltation, clogging or freezing.

1806.6 Seismic Design. Foundation walls and retaining walls shall be designed to resist seismic lateral pressures in accordance with 780 CMR 16.00.

780 CMR 1807.0 DAMPPROOFING, WATERPROOFING AND GROUNDWATER CONTROL

1807.1 Where required. Walls or portions thereof that retain earth and enclose interior spaces and floors below grade shall be waterproofed or dampproofed in accordance with 780 CMR 1807.0, with the exception of those spaces containing groups other than residential and institutional where such omission is not detrimental to the building or occupancy.

Ventilation for crawl spaces shall comply with 780 CMR 1202.4.

1807.1.1 Story Above Grade. Where a basement is considered a story above grade and the finished ground level adjacent to the basement wall is below the basement floor elevation for 25% or more of the perimeter, the floor and walls shall be dampproofed in accordance with 780 CMR 1807.2 and a foundation drain shall be installed in accordance with 780 CMR 1807.4.2. The foundation drain shall be installed around the portion of the perimeter where the basement floor is below ground level. The provisions of

780 CMR 1802.4.1, 1807.3 and 1807.4.1 shall not apply in this case.

1807.1.2 Underfloor Space. The finished ground level of an underfloor space such as a crawl space shall not be located below the bottom of the footings. Where there is evidence that the ground water table rises to within 6 inches (152 mm) of the ground level at the outside building perimeter or where there is evidence that the surface water does not readily drain from the building site, the ground level of the underfloor space shall be as high as the outside finished ground level, unless an approved drainage system is provided. The provisions of 780 CMR 1802.4.1, 1807.2, 1807.3 and 1807.4 shall not apply in this case.

1807.1.2.1 Flood Hazard Areas. For buildings and structures in flood hazard areas as established in 780 CMR 1612.3, the finished ground level of an underfloor space such as a crawl space shall be equal to or higher than the outside finished ground level.

1807.1.3 Ground-water Control. Where the ground-water table is lowered and maintained at an elevation not less than six inches (152 mm) below the bottom of the lowest floor, the floor and walls shall be dampproofed in accordance with 780 CMR 1807.2. The design of the system to lower the ground-water table shall be based on accepted principles of engineering that shall consider, but not necessarily be limited to, permeability of the soil, rate at which water enters the drainage system, rated capacity of pumps, head against which pumps are to pump; and the rated capacity of the disposal area of the system. The design shall also take into account any adverse impacts on utilities, structures or other facilities in the vicinity which would result from the lowering of groundwater levels.

1807.2 Dampproofing Required. Where hydrostatic pressure will not occur as determined by 780 CMR 1802.4.1, floors and walls for other than wood foundation systems shall be dampproofed in accordance with 780 CMR 1807.2. Wood foundation systems shall be constructed in accordance with AFPA TR7.

1807.2.1 Floors. Dampproofing materials for floors shall be installed between the floor and the base course required by 780 CMR 1807.4.1, except where a separate floor is provided above a concrete slab. Where installed beneath the slab, dampproofing shall consist of not less than 6-mil (0.006 inch; 0.152 mm) polyethylene with joints lapped not less than six inches (152 mm), or other approved methods or materials. Where permitted to be installed on top of the slab, dampproofing shall consist of mopped-on bitumen, not less than four-mil (0.004 inch; 0.102 mm) polyethylene, or other approved methods or materials. Joints in the membrane shall be lapped and sealed in accordance with the manufacturer's installation instructions.

1807.2.2 Walls. Dampproofing materials for walls shall be installed on the exterior surface of the wall, and shall extend from the top of the footing to above ground level. Dampproofing shall consist of a bituminous material, three pounds per square yard (16 N/m^2) of acrylic modified cement, ⅛-inch (3.2 mm) coat of surface-bonding mortar complying with ASTM C 887, any of the materials permitted for waterproofing by 780 CMR 1807.3.2, or other approved methods or materials.

1807.2.2.1 Surface Preparation of Walls. Prior to application of dampproofing materials on concrete walls, holes and recesses resulting from the removal of form ties shall be sealed with a bituminous material or other approved methods or materials. Unit masonry walls shall be parged on the exterior surface below ground level with not less than ⅜ inch (9.5 mm) of portland cement mortar. The parging shall be coved at the footing.

Exception. Parging of unit masonry walls is not required where a material is approved for direct application to the masonry.

1807.3 Waterproofing Required. Where the ground-water investigation required by 780 CMR 1802.4.1 indicates that a hydrostatic pressure condition exists, and the design does not include a ground-water control system as described in 780 CMR 1807.1.3, walls and floors shall be waterproofed in accordance with 780 CMR 1807.3.

1807.3.1 Floors. Floors required to be waterproofed shall be of concrete, designed and constructed to withstand the hydrostatic pressures to which the floors will be subjected. Waterproofing shall be accomplished by placing a membrane of rubberized asphalt, butyl rubber, or not less than six-mil (0.006 inch; 0.152 mm) polyvinyl chloride with joints lapped not less than six inches (152 mm) or other approved materials under the slab. Joints in the membrane shall be lapped and sealed in accordance with the manufacturer's installation instructions.

1807.3.2 Walls. Walls required to be waterproofed shall be of concrete or masonry and shall be designed and constructed to withstand the hydrostatic pressures and other lateral loads to which the walls will be subjected. Waterproofing shall be applied from the bottom of the wall to not less than 12 inches (305 mm) above the maximum elevation of the ground water table. The remainder of the wall shall be dampproofed in accordance with 780 CMR 1807.2.2. Waterproofing shall consist of two-ply hot-mopped felts, not less than six-mil (0.006 inch; 0.152 mm) polyvinyl chloride, 40-mil (0.040 inch; 1.02 mm) polymer-modified asphalt, six-mil (0.006 inch;

0.152 mm) polyethylene or other approved methods or materials capable of bridging nonstructural cracks. Joints in the membrane shall be lapped and sealed in accordance with the manufacturer's installation instructions.

1807.3.2.1 Surface Preparation of Walls. Prior to the application of waterproofing materials on concrete or masonry walls, the walls shall be prepared in accordance with 780 CMR 1807.2.2.1.

1807.3.3 Joints and Penetrations. Joints in walls and floors, joints between the wall and floor, and penetrations of the wall and floor shall be made watertight utilizing approved methods and materials.

1807.4 Subsoil Drainage System. Where a hydrostatic pressure condition does not exist, dampproofing shall be provided and a base shall be installed under the floor and a drain installed around the foundation perimeter. A subsoil drainage system designed and constructed in accordance with 780 CMR 1807.1.3 shall be deemed adequate for lowering the ground-water table.

1807.4.1 Floor Base Course. Floors of basements, except as provided for in 780 CMR 1807.1.1, shall be placed over a floor base course not less than 4 inches (102 mm) in thickness that consists of gravel or crushed stone containing not more than 10% of material that passes through a No. 4 (4.75 mm) sieve.

Exception. Where a site is located in well-drained gravel or sand/gravel mixture soils, a floor base course is not required.

1807.4.2 Foundation Drain. A drain shall be placed around the perimeter of the foundation that consists of gravel or crushed stone containing not more than 10% material that passes through a No. 4 (4.75 mm) sieve. The drain shall extend a minimum of 12 inches (305 mm) beyond the outside edge of the footing. The thickness shall be such that the bottom of the drain is not higher than the bottom of the base under the floor, and that the top of the drain is not less than six inches (152 mm) above the top of the footing. The top of the drain shall be covered with an approved filter membrane material. Where a drain tile or perforated pipe is used, the invert of the pipe or tile shall not be higher than the floor elevation. The top of joints or the top of perforations shall be protected with an approved filter membrane material. The pipe or tile shall be placed on not less than two inches (51 mm) of gravel or crushed stone complying with 780 CMR 1807.4.1, and shall be covered with not less than six inches (152 mm) of the same material.

1807.4.3 Drainage Discharge. The floor base and foundation perimeter drain shall discharge by gravity or mechanical means into an approved drainage system that complies with the *International Plumbing Code*.

Exception. Where a site is located in well-drained gravel or sand/gravel mixture soils, a dedicated drainage system is not required.

1807.4.4 Erosion Protection. Where water impacts the ground from the edge of the roof, downspout, scupper or other rainwater collection or diversion device, provisions shall be made to prevent soil erosion and direct the water away from the foundation.

1807.5 Impacts on Groundwater Levels. Below-grade structures and their appurtenances shall be designed and constructed so as not to cause changes to the temporary or permanent groundwater level if such changes could adversely impact nearby structures or facilities including deterioration of timber piles, settlement, flooding or other impacts.

780 CMR 1808.0 PIER AND PILE FOUNDATIONS

1808.1 Definitions. The following words and terms shall, for the purposes of 780 CMR 1808.0, have the meanings shown in 780 CMR 1808.1

PIER FOUNDATIONS. Piers are defined herein as circular or non-circular deep foundation elements constructed of concrete that are installed or cast-in-place in holes advanced to the bearing stratum using non-displacement excavation methods. Piers develop their load-bearing capacity through end-bearing and/or skin friction in the bearing stratum. Piers shall have a minimum lateral dimension of not less than 12 inches (305 mm). The base of the pier may be enlarged to increase the bearing area (referred to as a belled pier). Pier foundations include foundation types referred to as caissons and drilled shafts.

PILE FOUNDATIONS. Piles are deep foundation elements constructed of wood, steel or concrete, driven, jacked, cast in-place, or a combination thereof. Piles develop their load-bearing capacity through end-bearing and/or skin friction in the bearing stratum. Types of pile foundations covered by the provisions of 780 CMR include timber, precast concrete, structural steel, concrete-filled steel pipe or tube, steel-cased concrete (mandrel-driven shell), enlarged base piles (pressure-injected footings), hollow-stem augered piles, small diameter grouted piles and caisson piles (concrete-filled pipe with steel core socketed into bedrock).

1808.2 Piers and Piles - General Requirements.

1808.2.1 General. Pier and pile foundations shall be designed and installed on the basis of a foundation investigation as defined in 780 CMR 1802. The design and installation shall be under the direct supervision of a registered design professional knowledgeable in the field of geotechnical engineering and pier or pile foundations who shall verify that the piers or piles as installed satisfy the design criteria. The investigation and report shall conform to the provisions of 780 CMR 1802.0.

1808.2.2 Special Types of Piers and Piles. Types of piers and piles not specifically covered by the provisions of 780 CMR 1808.0 may be permitted in accordance with 780 CMR 1801.3.

1808.2.3 Pier and Pile Caps. Pier and pile caps shall be of reinforced concrete, and shall include all elements to which piles or piers are connected, including beams and mats. The soil immediately below the cap shall not be considered as carrying any vertical load. The tops of piles or piers shall be embedded not less than three inches (76 mm) into caps and the caps shall extend at least four inches (102 mm) beyond the edges of piles or piers. The tops of piles or piers shall be cut back to sound material before capping.

1808.2.4 Stability. Piers or piles shall be braced to provide lateral stability in all directions. Three or more piles connected by a rigid cap shall be considered braced, provided that the piles are located in radial directions from the centroid of the group not less than 60 degrees (1 rad) apart. A two-pile group in a rigid cap shall be considered to be braced along the axis connecting the two piles. Methods used to brace piers or piles shall be subject to the approval of the building official.

Piles supporting walls shall be driven alternately in lines spaced at least one foot (305 mm) apart and located symmetrically under the center of gravity of the wall load carried, unless effective measures are taken to provide for eccentricity and lateral forces, or the wall piles are adequately braced to provide for lateral stability. A single row of piles without lateral bracing is permitted for one- and two-family dwellings and lightweight construction not exceeding two stories or 35 feet (10,668 mm) in height, provided the centers of the piles are located within the width of the foundation wall.

Individual columns supported on piles shall be designed for eccentricity between the column and the centroid of the supporting piles equal to a minimum of three inches (76 mm) or the actual eccentricity, whichever is greater. The design shall account for such eccentricity through one of the following methods:

1. By supporting the column on a minimum of three piles in a triangular pattern.
2. By designing walls, grade beams or structural floors to resist the bending moment induced by the eccentricity.
3. By designing the piles, column or both to resist the bending moment induced by the eccentricity and providing adequate lateral restraint at the top of the piles to resist the lateral thrust due to the bending moment.

1808.2.5 Structural Integrity. Piers or piles shall be installed in such a manner and sequence as to prevent distortion or damage to piles being installed or already in place to the extent that such distortion or damage affects the structural integrity of the piles.

When piles have been damaged in driving, or have been driven in locations and alignment other than those indicated on the plans, or have capacities less than required by the design, the affected pile groups and pile caps shall be investigated, and if necessary, the pile groups or pile caps shall be redesigned or additional piles shall be driven to replace the defective piles.

1808.2.6 Spacing. The minimum center-to-center spacing of piles shall be not less than twice the average diameter of a round pile, nor less than 1¾ times the diagonal dimension of a rectangular pile. When driven to or penetrating into rock, the spacing shall be not less than 24 inches (610 mm). When receiving principal support from end-bearing on materials other than rock or through frictional resistance, the spacing shall be not less than 30 inches (762 mm) or as provided in 780 CMR 1810.2 Enlarged Base Piles.

The minimum center-to-center spacing between adjacent piers designed for friction support shall be not less than two times the shaft diameter.

1808.2.7 Splices. Splices shall be constructed so as to provide and maintain true alignment and position of the component parts of the pier or pile during installation and subsequent thereto and shall be of adequate strength to transmit the vertical and lateral loads and moments occurring at the location of the splice during driving and under service loading. Splices shall develop not less than 50% of the capacity of the pier or pile in bending. In addition, splices occurring in the upper ten feet (3048 mm) of the embedded portion of the pier or pile shall be capable of resisting at allowable working stresses the moment and shear that would result from an assumed eccentricity of the pier or pile load of three inches (76 mm), or the pier or pile shall be braced in accordance with 780 CMR 1808.2.4 to other piers or piles that do not have splices in the upper ten feet (3048 mm) of embedment.

1808.2.8 Allowable Pier or Pile Loads.

1808.2.8.1 General. The allowable load on piles or piers shall not exceed the allowable load-bearing capacity in the bearing strata determined in accordance with 780 CMR 1808.2.8.2 for piles or 780 CMR 1808.2.8.3 for piers, or the allowable load on the pile or pier cross-section computed using the allowable stresses for the particular type of pile or pier in accordance with 780 CMR 1809.0 through 1812.0. The allowable load may also be limited by the bearing capacity of weaker strata underlying the bearing stratum (780 CMR 1808.2.8.4), group action (780 CMR 1808.2.8.4), drivability (780 CMR 1808.2.16) or settlement (780 CMR 1808.2.12).

1808.2.8.2 Piles.

1808.2.8.2.1 Allowable Load-bearing Capacity. The allowable load-bearing capacity obtained from bearing on or embedment in the pile bearing strata shall be determined by load tests performed in accordance with 780 CMR 1808.2.8.2.4, or by use of applicable formulas as permitted in 780 CMR 1808.2.8.2.2. The allowable load-bearing capacity of jacked piles shall be determined in accordance with 780 CMR 1808.2.8.2.5.

The allowable pile capacity determined from load tests can be applied to other piles within the area of substantially similar subsurface conditions as those for the test pile, providing the performance of the test pile has been satisfactory and the remaining piles are of the same type, shape and size as the test pile and are installed using the same methods and equipment and are driven into the same bearing strata as the load-tested pile to an equal or greater penetration resistance.

Pile load tests required by the provisions of 780 CMR 1808.2.8.2.1 may be waived by the building official, where justified, upon submittal of substantiating data prepared by a registered design professional which include experience and/or performance records for the proposed pile installation under similar soil and loading conditions.

1808.2.8.2.2 Pile Capacity Not Exceeding 50 Tons. For piles with a design load capacity not exceeding 50 tons, the allowable load-bearing capacity can be determined using either the driving formula or friction formula in clay as permitted in 780 CMR 1808.2.8.2.2, or the formula for enlarged base piles in 780 CMR 1810.2.4.

Driving Formula.

1. Where the design load capacity of the pile does not exceed 50 tons, the allowable load may be computed by means of the following driving formula:

$$R = \frac{2E}{(S + C)}$$

where:

R = allowable pile load in pounds;

E = energy per blow in foot-pounds;

S = penetration of last blow or average penetration of last few blows expressed in inches; and

C = constant equal to 1.0 for drop hammer and 0.1 for steam or air hammer.

2. When the design load capacity of a pile exceeds 50 tons, the required driving resistance shall be increased above that required by the driving formula based on load tests or past experience under similar conditions.
3. The value of S must be determined with the hammer operating at 100% of the rated number of blows per minute for which the hammer is designed.
4. Any driving resistance developed in strata overlying the bearing material shall be discounted.
5. If the driving of the pile has been interrupted for more than one hour, the value of S shall not be determined until the pile is driven at least an additional 12 inches (305 mm), except when it encounters refusal on or is in a material of Classes 1 through 6.
6. When any pile is driven through a layer of gravel, sand or hard clay exceeding five feet in thickness, and through an underlying soft stratum to reach the bearing stratum, the bearing capacity shall not be determined in accordance with the driving formula, unless jetting is used during the entire driving of the pile through the layer of gravel, sand or hard clay or unless a hole is pre-excavated through said layer for each pile.

Friction Formula in Clay. Where the design load does not exceed 50 tons for driven concrete or timber piles, where predrilling does not remove more than 75% of the pile cross section, the allowable load on a pile stopped in soil of Material Class 10 (Table 1804.3) of medium to hard consistency may be based on a friction value of 500 psf of embedded pile surface. Higher design loads or other friction values shall be determined by pile load tests in accordance with 780 CMR 1808.2.8.2.4 or 780 CMR 1808.2.8.2.6.

The embedded length shall be the length of the pile below the surface of the Class 10 soil or below the surface of immediately overlying satisfactory bearing material. The area of embedded pile surface shall be computed by multiplying the embedded length by the perimeter of the smallest circle or polygon that can be circumscribed around the average section of the embedded length of the pile. The method of determining the allowable load described in 780 CMR 1808.2.8.2.2 shall not be used for a pile in which the drive pipe is withdrawn or for piles which are driven through the clay to or into firmer bearing materials.

In case these piles are in clusters, the allowable load on the cluster shall be computed for the smaller of the following two areas: the sum of the embedded pile surfaces of individual piles; or the area obtained by multiplying the perimeter of the polygon circumscribing the cluster at the surface of the satisfactory bearing material by the average embedded length of the piles.

1808.2.8.2.3 Pile capacity exceeding 50 tons. When the design load capacity of a pile exceeds 50 tons, the required driving resistance shall be determined based on one or more compression load tests unless waiver of such test(s) is approved by the building official.

1808.2.8.2.4 Compression Load Test. Compression load tests shall be performed in accordance with the following:

Required test Load. A single pile shall be load-tested to not less than twice the allowable design load. When two or more piles are to be tested as a group, the total load shall be not less than 1.5 times the allowable design load for the group. In no case should the load reaching the top of the bearing stratum under maximum test load for a single pile or pile group be less than the following:

1. Case A-piles designed as end-bearing piles: 100% of the allowable design load.
2. Case B-piles designed as friction piles: 150% of the allowable design load.

For piles designed as combination end-bearing and friction piles, Case A applies if the pile is designed to support more than 50% of its design in bearing; otherwise, Case B applies.

Internal Instrumentation. The test pile shall be instrumented in accordance with the requirements in paragraph 4.4.1 of ASTM D1143 to enable measurement or computation of the load in the pile where it enters the bearing stratum. For piles containing concrete, instrumentation shall be installed in the test pile to permit direct measurement of the elastic modulus of the pile. This requirement is waived for the following cases:

1. The test pile is installed within a casing that extends to within ten feet above the bearing stratum.
2. The pile to be tested has been functioning satisfactorily under load for a period of one year or more.
3. The pile is 30 feet long or less and no appreciable load will be supported above the bearing stratum.

Loading Procedure. Pile load tests shall be conducted in accordance with ASTM D1143, Standard Method of Testing Piles Under Static Axial Compressive Load, except that Section 5, Loading Procedures, shall be deleted and replaced by the following provisions:

1. Apply 25% of the allowable design load every 0.5 hour. Longer time increments may be used, but each time increment should be the same. In no case shall a load be changed if the rate of settlement is not decreasing with time.
2. At 200% of the allowable design load (or 150% for pile groups), maintain the load for a minimum of one hour and until the settlement (measured at the lowest point on the pile at which measurements are made) over a one-hour period is not greater than 0.01 in.
3. Remove 50% of the design load every 15 minutes until zero load is reached. Longer time increments may be used, but each should be the same.
4. Measure rebound at zero load for a minimum of one hour.
5. For each load increment or decrement, take readings at the top of the pile and on the internal instrumentation at one, two, four, eight and 15 minutes and at 15-minute intervals thereafter.

A load greater than 200% of the allowable design load (or 150% of the allowable design load for pile groups) may be applied at the top of the pile, using the above loading procedure, to ensure that the requirement for minimum load reaching the bearing stratum is fulfilled. Other optional methods listed in ASTM D1143 may be approved by the building official upon submittal in advance of satisfactory justification prepared by a registered design professional who is qualified in this field.

Selection of Design Load. Provided that the design load does not exceed 100% of the load supported in the bearing stratum (or ⅔ of the load supported in the bearing stratum for friction piles or pile groups) when the maximum test load is applied, then the allowable design load shall be the greater of the following:

1. Allowable design load based on settlement during loading: 50% of the applied test load which causes a gross settlement at the pile cutoff grade equal to the sum of: a) the theoretical elastic compression of the pile in inches assuming all the load on the butt is transmitted to the tip, plus b) 0.15 inch

(3.8 mm), plus c) 1% of the pile tip diameter or pile width in inches. If the settlements are so small that the load-settlement curve does not intersect the failure criterion, the allowable design load shall be 50% of the maximum test load.

2. Allowable design load based on the net settlement after rebound: 50% of the applied test load which results in a net settlement at the top of the pile of 0.5 inch (13 mm) after rebound for a minimum of one hour at zero load.

1808.2.8.2.5 Jacked Piles. Load testing of jacked piles shall be performed in accordance with the following:

1. Not less than 10% of jacked piles shall be load-tested to twice the design load (load test piles). All other jacked piles shall be founded in the same bearing stratum as the load test piles and shall be proof-loaded to 125% of design load (production piles).
2. For production piles, the 125% of design load shall be maintained for at least 30 minutes. Acceptability criteria: during final 15 minutes of load, the rate is not progressive (plot is linear or decreasing when settlement is plotted against logarithm of time); and the rate of settlement is equal to or less than that observed for load test piles during the corresponding time period under 125% of design load.
3. Settlement readings shall be plotted after one, two, four, eight, and 15 minutes, and at 15-minute intervals thereafter. Load shall be maintained on production piles until acceptability criteria are met.
4. For load test piles, the load shall be applied directly to 125% of design load and maintained for not less than 30 minutes, and until the settlement rate is not progressive (as defined above). Load shall then be increased to twice the design load and maintained constant for not less than four hours. Settlement during the four hour period shall not exceed 0.050 inches (1.3 mm). In the event that settlement exceeds 0.050 inches (1.3 mm) in four hours, the pile shall be deemed unacceptable for 50% of the final load. The allowable load on the rejected pile may be established by performing an additional load test at the lesser design load. The design load shall not exceed 50% of the load maintained for a four hour period during which time settlement did not exceed 0.050 inches (1.3 mm).

1808.2.8.2.6 Tension Load Tests. The allowable load on piles in tension shall be verified by test unless it is waived by the building official. Pile load test may be waived by the building official, where justified, upon submittal of substantiating data which includes experience and/or performance records for pile installations under similar soil and loading conditions prepared by a registered design professional experienced in the geotechnical aspects of foundation design.

Required Load Test. A single pile or a pile group shall be load tested to not less than 200% of the design load for transient loads (i.e., earthquake and wind) and 250% for sustained loads.

Test Setup and Loading Procedure. The load test setup, instrumentation and loading procedure shall be in accordance with ASTM D3689.

Selection of Design Load. Provided the allowable design load does not exceed the allowable stresses in the pile materials, the allowable design load shall be the lower of the following:

1. 50% (for transient loads) or 40% (for sustained loads) of the applied test load which results in a net upward movement of 0.5 inch at the top of the pile after removal of the maximum test load (The gross upward movement minus the rebound movement).
2. 50% (for transient loads) or 40% (for sustained loads) of the applied test load which results in continuous upward movement with no increase in load.

1808.2.8.3 Piers. The allowable bearing pressure on the bottom of the pier shall be in accordance with 780 CMR 1804. Additional load may be carried by using higher bearing pressures than allowed by 780 CMR 1804 and/or by friction on the sides of the pier embedded in suitable bearing material based on recommendations by a registered design professional and subject to the approval of the building official. Such recommendations shall be based on the results of load tests or other suitable tests or analyses carried out to determine side friction and/or end bearing of piers installed in the same bearing stratum.

1808.2.8.4 Load-bearing Capacity. Piers, individual piles and groups of piles or piers shall develop ultimate load capacities of at least twice the design working loads in the designated load-bearing layers. Analysis shall show that no soil layer underlying the designated load-bearing layers causes the load-bearing capacity safety factor to be less than two.

Group Action. In cohesive soils, the compressive load capacity of a group of friction piles shall be analyzed by a generally accepted engineering method, and, where such analysis indicates, the individual allowable pile load shall be reduced accordingly.

1808.2.8.5 Bent Piers or Piles. The load-bearing capacity of piers or piles discovered to have a sharp or sweeping bend shall be determined by an approved method of analysis or by load testing a representative pier or pile.

1808.2.8.6 Overloads on Piers or Piles. The maximum compressive load on any pier or pile due to mislocation shall not exceed 110% of the allowable design load.

1808.2.9 Lateral Support.

1808.2.9.1 General. Any soil other than fluid soil shall be deemed to afford sufficient lateral support to the pier or pile to prevent buckling and to permit the design of the pier or pile in accordance with accepted engineering practice and the applicable provisions of 780 CMR.

1808.2.9.2 Unbraced Piles. Piles standing unbraced in air, water or in fluid soils shall be designed as columns in accordance with the provisions of 780 CMR. Such piles driven into firm ground can be considered fixed and laterally supported at five feet (1524 mm) below the ground surface and in soft material at ten feet (3048 mm) below the ground surface unless determined otherwise by a registered design professional.

1808.2.9.3 Allowable Lateral Load. Where required by the design, the lateral load capacity of a pier, a single pile or a pile group shall be determined by an approved method of analysis or by lateral load tests to at least twice the proposed design working load. The load test setup instrumentation and loading procedure shall be in accordance with ASTM D3966. The design load shall be selected by the responsible registered design professional, based upon interpretation of the load-deflection data from the load test. The resulting allowable load shall not be more than one-half of that test load that produces a gross lateral movement of one inch (25 mm) at the ground surface.

1808.2.10 Use of Higher Allowable Pier or Pile Stresses. Allowable stresses greater than those specified for piers or for each pile type in 780 CMR 1809.0 through 1812.0 are permitted where supporting data justifying such higher stresses is filed with the building official. Such substantiating data shall include:

1. A soils investigation in accordance with 780 CMR 1802, wave equation analyses of pile driveability, analyses of load transfer during testing, and prediction of performance during long term service.
2. Pier or pile load tests in accordance with 780 CMR 1808.2.8.2.4, regardless of the load supported by the pier or pile.

1808.2.11 Piles and Piers in Subsiding Areas. Where piles and piers are installed through subsiding fills or other subsiding strata and derive support from underlying firmer materials, consideration shall be given to the downward frictional forces that may be imposed on the piles or piers by the subsiding upper strata.

Where the influence of subsiding fills is considered as imposing loads on the pile or pier, the allowable stresses specified in 780 CMR 1809 through 1812 are permitted to be increased where satisfactory substantiating data are submitted.

1808.2.12 Settlement Analysis. The settlement of piers, individual piles or groups of piles shall be estimated based on approved methods of analysis. The predicted settlement shall neither cause harmful distortion of, or instability in, the structure, nor cause any stresses to exceed allowable values.

1808.2.13 Pre-excavation. The use of jetting, augering or other methods of pre-excavation shall be in accordance with the recommendations of the registered design professional. Where used, pre-excavation shall be carried out in the same manner as used for piers or piles subject to load tests and in such a manner that will not impair the carrying capacity of the piers or piles already in place or damage adjacent structures. Pile tips shall be driven below the pre-excavated depth until the required resistance or penetration is obtained.

1808.2.14 Installation Sequence. Piles shall be installed in such sequence as to avoid compacting the surrounding soil to the extent that other piles cannot be installed properly, and to prevent ground movements that are capable of damaging adjacent structures.

1808.2.15 Use of Vibratory Drivers. Vibratory drivers shall only be used to install piles where the pile load capacity is verified by load tests in accordance with 780 CMR 1808.2.8.2.4. The installation of production piles shall be controlled according to power consumption, rate of penetration or other approved means that ensure pile capacities equal or exceed those of the test piles.

1808.2.16 Pile Driveability. Pile cross sections shall be of sufficient size and strength to withstand handling and driving stresses without damage to the pile and to provide sufficient stiffness to transmit the required driving forces. Driven piles of uniform cross section or tapered piles shall have a minimum nominal diameter of eight inches (200 mm) except as provided in

780 CMR 1809.1.3.3 for timber piles. Tapered shoes or points of lesser dimensions may be attached to the pile unit.

1808.2.17 Protection of Pile and Pier Materials. Where boring records or site conditions indicate possible deleterious action on pier or pile materials because of soil constituents, changing water levels or other factors, the pier or pile materials shall be adequately protected by materials, methods or processes in accordance with the recommendations of the registered design professional. Protective materials shall be applied to the piles so as not to be rendered ineffective by driving. The effectiveness of such protective measures for the particular purpose shall have been thoroughly established by satisfactory service records or other evidence that demonstrates their effectiveness.

Steel and Steel-concrete Piles. At locations where steel and steel-concrete piles will be in contact with any material which is corrosive to the steel, one of the following procedures shall be used for protection, or any other method which will satisfy the requirements of the building official:

1. Remove all objectionable material.
2. Effectively protect the steel surface from pile cutoff grade to a grade 15 feet (4.6 m) below the bottom of the objectionable material by means of:
    a. cathodic protection as approved by the building official;
    b. an approved encasement of not less than three inches (76 mm) of dense concrete;
    c. an effective protective coating subject to the approval of the building official; or
    d. providing an excess steel thickness of 1/8 inch (3.2 mm) beyond design requirements on all exposed steel surfaces.

1808.2.18 Use of Existing Piers or Piles. Piles or piers that have previously supported a partially or fully demolished structure shall not be used for support of new construction unless satisfactory evidence is submitted to the building official which indicates that the piles or piers have not been adversely impacted by the demolition, are sound, have adequate capacity to support the new design loads, and meet all of the requirements of 780 CMR 18.00. The capacities of such piles or piers shall be determined by analyses, load testing or redriving.

Requirements for Piles. The design load for piles to be reused shall not exceed the greater of the following values:

1. Actual sustained load determined to have been previously supported satisfactorily by the piles, up to a maximum of 120 tons
2. The documented, as-built design capacity of the piles, as confirmed by prior load testing
3. Design capacity determined by analyses and confirmed by new load testing or by redriving per 780 CMR 1808.2.8.2.2 on one or more piles representative of each configuration (s) of pile and subsurface conditions.

1808.2.19 Heaved Piles. Adequate provision shall be made to observe pile heave. Accurate reference points shall be established on each pile immediately after installation; for cast-in-place piles with unfilled corrugated shells, the reference point shall be at the bottom of the pile. If, following the installation of other piles in the vicinity, heaving of ½ inch (13 mm) or more occurs, the heaved piles shall be re-driven to develop the required capacity and penetration, or the capacity of the pile may be verified by load tests in accordance with 780 CMR 1808.2.8.2.4.

1808.2.20 Identification. Pier or pile materials shall be identified for conformity to the specified grade with this identity maintained continuously from the point of manufacture to the point of installation or shall be tested by an approved agency to determine conformity to the specified grade. The approved agency shall furnish an affidavit of compliance to the building official.

1808.2.21 Pier or Pile Location Plan. A plan showing the location and designation of piers or piles by an identification system shall be filed with the building official prior to installation of such piers or piles. Detailed records for piers or individual piles shall bear an identification corresponding to that shown on the plan.

1808.2.22 Special Inspection. Special inspections shall be provided for piles and piers, respectively. The owner shall engage a registered design professional who shall submit his qualifications in writing to the building official. This design professional, or his representative, who must be qualified by experience and training, shall be present at all times while piles and piers are being installed to observe all work. The design professional or his representative shall make an accurate record of the following:

1. For driven piles, the material and the principal dimensions of each pile, weight and fall of the ram, the type, size and make of hammer, cushion blocks, the number of blows per minute, the energy per blow, the number of blows per inch for the last six inches (150 mm) of driving, together with the grades at point and cutoff and any other pertinent details. For cast-in-place piles, installation equipment and methods used, casings, pile dimensions, reinforcement, grouting volumes and procedures used, and all other pertinent

installation data.

For piers, pier installation procedures including observations and tests of the bearing material in place, pier dimensions and placement of concrete and reinforcement. When direct inspection of the bearing surface is impossible, a suitable method shall be employed, to verify the condition of the bearing material and to make the measurements and tests.

A copy of these records shall be signed by the registered design professional, and filed in the office of the building official.

1808.3 Seismic Design of Piers or Piles.

1808.3.1 Seismic Reinforcement. Piles and piers shall have minimum longitudinal reinforcement and confining reinforcement in accordance with the provisions for specific pile types and piers in 780 CMR 1809.0 through 1812.0.

Ends of hoops, spirals and ties shall be terminated with seismic hooks, as defined in Section 21.1 of ACI 318, turned into the confined concrete core. The minimum transverse steel ratio for confinement shall not be less than one-half of that required for columns.

Where a minimum length for reinforcement or the extent of closely spaced confining reinforcement is specified at the top of the pier or pile, provisions shall be made so that those specified lengths or extents are maintained after pier or pile cut-off.

Where confining reinforcement is specified at the top of the pile or pier, alternative measures for laterally confining concrete and maintaining toughness and ductile-like behavior at the top of the pile or pier will be permitted provided the design is such that any hinging occurs in the confined region.

1808.3.2 Seismic Bending Design. Piles or piers for structures assigned to Seismic Design Category D in accordance with 780 CMR 1616 shall be designed and constructed to withstand the maximum imposed curvatures from earthquake ground motions and structure response. Curvatures shall include free-field soil strains modified for soil-pile-structure interaction coupled with pier or pile deformations induced by lateral pier or pile resistance to structure seismic forces. Concrete piers or piles on Site Class E or F sites, as determined in 780 CMR 1615.1.1, shall be designed and detailed in accordance with Sections 21.4.4.1, 21.4.4.2 and 21.4.4.3 of ACI 318 within seven pile diameters of the pile cap and the interfaces of soft to medium stiff clay or liquefiable strata.

1808.3.3 Pile Cap Seismic Connection. Piles or piers for structures assigned to Seismic Design Category C and D in accordance with 780 CMR 1616 shall be connected to the pile or pier caps in accordance with the following provisions.

1808.3.3.1 Concrete Piles and Piers. These provisions apply to the pile types and piers covered in 780 CMR 1809.2, 1810.0 and 1812.0. The piles or piers shall be connected to the pile or pier cap by extending the longitudinal reinforcing into the cap for a distance equal to the development length as specified in ACI 318. The development length to be provided in the cap is the full development length for compression without reduction in length for excess area. Field-placed dowels anchored in the pile or pier concrete at least twice the required cap development length are acceptable.

For concrete-filled steel pipe and tube piles, longitudinal reinforcement shall be provided at the top of the pile in accordance with 780 CMR 1810.6.4.1, and the reinforcement shall be anchored into the pile cap in accordance with the requirements of 780 CMR 1808.3.3.1.

For precast prestressed concrete piles in structures assigned to Seismic Design Category C, the pile cap connection can be made by extending the exposed pile reinforcing strand into the pile cap with an embedment length sufficient to develop the strength of the reinforcing strand. This is not permitted for piles in structures assigned to Seismic Design Category D.

1808.3.3.2 Structural Steel Piles. Structural steel piles covered in 780 CMR 1809.3 shall be connected to the pile cap with a connection detail designed for a minimum tensile force equal to 10% of the pile compression design load. The pile cap connection shall be made by means other than concrete bond to the bare steel section.

1808.3.3.3 Seismic Design Category D. For structures assigned to Seismic Design Category D the pile or pier cap connection shall meet the following additional requirements. For piles or piers required to resist uplift forces or provide rotational restraint, the design of the anchorage into the pile or pier cap shall consider the combined effect of axial forces due to uplift and bending moments due to fixity at the cap. The anchorage shall develop a minimum of 25% of the strength of the pile or pier in tension and shall be capable of developing the following load capacities:

1. In the case of uplift, the lesser of the nominal tensile strength of the longitudinal reinforcement in a concrete pile or pier, or the nominal tensile strength of a steel pile, or the pile or pier uplift soil nominal strength factored by 1.3 or the axial tension force resulting from the load combinations of 780 CMR 1605.4.
2. In the case of rotational restraint, the lesser of the axial and shear forces, and moments resulting from the load

combinations of 780 CMR 1605.4 or development of the full axial, bending and shear nominal strength of the pile or pier.

1808.3.4 Seismic Foundation Ties. Pile or pier foundations for structures assigned to Seismic Design Category C and D in accordance with 780 CMR 1616 shall be interconnected by ties capable of carrying, in tension and compression, a force equal to the product of the larger pile cap or column load times the seismic coefficient S_{DS} divided by ten. Ties are not required where it can be demonstrated that equivalent restraint is provided by reinforced concrete beams within slabs-on-grade or reinforced concrete slabs-on-grade or confinement by competent rock, hard cohesive soils, or very dense granular soils.

Exception. Piers supporting foundation walls, isolated interior posts detailed so the pier is not subject to lateral loads, lightly loaded exterior decks and patios, of Group R, Division 3 and Group U, Division 1 occupancies not exceeding two stories of light-frame construction, are not subject to interconnection if it can be shown the soils are of adequate stiffness, subject to the approval of the building official.

780 CMR 1809.0 DRIVEN PILE FOUNDATIONS

1809.1 Timber Piles. Timber piles shall be designed in accordance with the AFPA NDS.

1809.1.1 Materials. Round timber piles shall conform to ASTM D 25. Round timber piling shall be new longleaf, shortleaf, loblolly or slash species of Southern pine, oak, Douglas fir or other woods of similar strength and physical characteristics. Sawn timber piles shall conform to DOC PS-20.

1809.1.2 Preservative Treatment. Timber piles used to support permanent structures shall be treated in accordance with 780 CMR 1809.1.2 unless it is established that the tops of the untreated timber piles will be below the lowest ground water level assumed to exist during the life of the structure. Preservative and minimum final retention shall be in accordance with AWPA C3 for round timber piles, and AWPA C24 for sawn timber piles. Preservative-treated timber piles shall be subject to a quality control program administered by an approved agency. Pile cutoffs shall be treated in accordance with AWPA M4.

1809.1.3 Allowable Load.

1809.1.3.1 Allowable Stress. The allowable stress in the timber shall not exceed 1,000 psi (6.9 MPa) in compression at the critical cross-sectional area taken at the top of the bearing stratum. Piles designed for end bearing on materials of Classes 1 and 2 in Table 1804.3 shall be designed for a maximum stress of 500 psi (3.4 MPa) in compression on the pile cross-sectional area at the tip.

1809.1.3.2 Maximum Load. The load on timber piles shall not exceed the allowable load specified in 780 CMR 1808.2.8 nor 35 tons, whichever is smaller.

1809.1.3.3 Minimum Dimensions. Timber piles shall be no less than six inches (152 mm) in diameter at the tip.

1809.1.4 Precautions During Driving.

1809.1.4.1 Hammer Energy. Pile hammer energy shall be selected to prevent damage to the pile, but in no case shall the maximum hammer energy, as rated by the manufacturer, exceed 18,000 ft.-lbs.

1809.1.4.2 End-supported Piles. Any sudden decrease in driving resistance of an end-supported timber pile shall be investigated with regard to the possibility of damage. If the sudden decrease in driving resistance cannot be correlated to load-bearing data, the pile shall be removed for inspection or rejected.

1809.2 Precast Concrete Piles.

1809.2.1 General. The materials, reinforcement and installation of precast concrete piles shall conform to 780 CMR 1809.2.1.1 through 1809.2.1.4.

1809.2.1.1 Design and Manufacture. Piles shall be designed and manufactured in accordance with accepted engineering practice to resist all stresses induced by handling, driving and service loads. When driven to or into bearing materials of Classes 1 and 2 inclusive, or through materials containing boulders, piles shall have metal tips of approved design.

1809.2.1.2 Minimum Dimension. The minimum lateral dimension shall be eight inches (203 mm). Corners of square piles shall be chamfered.

1809.2.1.3 Reinforcement. Longitudinal steel shall be arranged in a symmetrical pattern and shall be laterally tied with steel ties or wire spiral spaced not more than four inches (102 mm) apart, center-to-center, for a distance of two feet (610 mm) from the ends of the pile; and not more than six inches (152 mm) elsewhere except that at the ends of each pile, the first five ties or spirals shall be spaced one inch (25.4 mm) center to center. The gage of ties and spirals shall be as follows:

1. For piles having a diameter of 16 inches (406 mm) or less, wire shall not be smaller than 0.22 inch (5.6 mm) (No. 5 gage).
2. For piles having a diameter of more than 16 inches (406 mm) and less than 20 inches (508 mm), wire shall not be smaller than

0.238 inch (6 mm) (No. 4 gage).

3. For piles having a diameter of 20 inches (508 mm) and larger, wire shall not be smaller than ¼ inch (6.4 mm) round or 0.259 inch (6.6 mm) (No. 3 gage).

1809.2.1.4 Installation. Piles shall be handled and driven so as not to cause injury or overstressing, which affects durability or strength.

1809.2.2 Precast Nonprestressed Piles. Precast non-prestressed concrete piles shall conform to 780 CMR 1809.2.2.1 through 1809.2.2.5.

1809.2.2.1 Materials. Concrete shall have a 28-day specified compressive strength (f'^c) of not less than 4,000 psi (20.68 Mpa).

1809.2.2.2 Minimum Reinforcement. The minimum amount of longitudinal reinforcement shall be 0.8% of the concrete section and shall consist of at least four bars.

1809.2.2.2.1 Seismic Reinforcement in Seismic Design Category C. Where a structure is assigned to Seismic Design Category C in accordance with 780 CMR 1616, the following shall apply. Longitudinal reinforcement with a minimum steel ratio of 0.01 shall be provided throughout the length of precast concrete piles. Within three pile diameters of the bottom of the pile cap, the longitudinal reinforcement shall be confined with closed ties or spirals of a minimum ⅜ inch (9.5mm) diameter. Ties or spirals shall be provided at a maximum spacing of eight times the diameter of the smallest longitudinal bar, not to exceed six inches (152 mm). Throughout the remainder of the pile, the closed ties or spirals shall have a maximum spacing of 16 times the smallest longitudinal-bar diameter, not to exceed eight inches (203 mm).

1809.2.2.2.2 Seismic Reinforcement in Seismic Design Category D. Where a structure is assigned to Seismic Design Category D in accordance with 780 CMR 1616, the requirements for Seismic Design Category C in 780 CMR 1809.2.2.2.1 shall apply except as modified in 780 CMR 1809.2.2.2.2. Transverse confinement reinforcement consisting of closed ties or equivalent spirals shall be provided in accordance with Sections 21.4.4.1, 21.4.4.2 and 21.4.4.3 of ACI 318 within three pile diameters of the bottom of the pile cap. For other than Site Class E or F, or liquefiable sites and where spirals are used as the transverse reinforcement, it shall be permitted to use a volumetric ratio of spiral reinforcement of not less than one-half that required by Section 21.4.4.1(a) of ACI 318.

1809.2.2.3 Allowable Stresses. The allowable compressive stress in the concrete shall not exceed 33% of the 28-day specified compressive strength (f'^c), nor 1,600 psi (11.0 MPa), applied to the gross cross-sectional area of the pile. The allowable compressive stress in the reinforcing steel shall not exceed 40% of the yield strength of the steel (f_y) or a maximum of 30,000 psi (207 MPa). The allowable tensile stress in the reinforcing steel shall not exceed 50% of the yield strength of the steel (f_y) or a maximum of 24,000 psi (165 Mpa).

1809.2.2.4 Installation. A precast concrete pile shall not be driven before the concrete has attained a compressive strength of at least 75% of the 28-day specified compressive strength (f'_c), but not less than the strength sufficient to withstand handling and driving forces.

1809.2.2.5 Concrete Cover. Reinforcement for piles that are not manufactured under plant conditions shall have a concrete cover of not less than two inches (51 mm).

Reinforcement for piles manufactured under plant control conditions shall have a concrete cover of not less than 1¼ inches (32 mm) for No. 5 bars and smaller, and not less than 1½ inches (38 mm) for No. 6 through No. 11 bars except that longitudinal bars spaced less than 1½ inches (38 mm) clear distance apart shall be considered bundled bars for which the minimum concrete cover shall be equal to that for the equivalent diameter of the bundled bars.

Reinforcement for piles exposed to sea water shall have a concrete cover of not less than three inches (76 mm).

1809.2.3 Precast Prestressed Piles. Precast prestressed concrete piles shall conform to the requirements of 780 CMR 1809.2.3.1 through 1809.2.3.5.

1809.2.3.1 Materials. Prestressing steel shall conform to ASTM A 416. Concrete shall have a 28-day specified compressive strength (f'_c) of not less than 5,000 psi (34.48 Mpa).

1809.2.3.2 Design. Precast prestressed piles shall be designed to resist stresses induced by handling and driving as well as by loads. The effective prestress in the pile shall not be less than 400 psi (2.76 MPa) for piles up to 30 feet (9144 mm) in length, 550 psi (3.79 MPa) for piles up to 50 feet (15 240 mm) in length, and 700 psi (4.83 MPa) for piles greater than 50 feet (15 240 mm) in length.

Effective prestress shall be based on an assumed loss of 30,000 psi (207 MPa) in the prestressing steel. The tensile stress in the prestressing steel shall not exceed the values specified in ACI 318.

1809.2.3.2.1 Design in Seismic Design Category C. Where a structure is assigned to Seismic Design Category C in accordance with 780 CMR 1616.0, the following shall apply. The minimum volumetric ratio of spiral reinforcement shall not be less than 0.007 or the amount required by the following formula for the upper 20 feet (6096 mm) of the pile:

EQUATION 18-4

$$\rho_s = 0.12 f'_c / f_{yh}$$

where:

f'_c = Specified compressive strength of concrete psi (MPa).

f_{yh} = Yield strength of spiral reinforcement ≤ 85,000 psi (586 MPa).

r_s = Spiral reinforcement index (vol. spiral/ vol. core).

At least ½ the volumetric ratio required by Equation 18-4 shall be provided below the upper 20 feet (6096 mm) of the pile.

The pile cap connection by means of dowels as indicated in 780 CMR 1803.3.3 is permitted. Pile cap connection by means of developing pile reinforcing strand is permitted provided that the pile reinforcing strand results in a ductile connection.

1809.2.3.2.2 Design in Seismic Design Category D. Where a structure is assigned to Seismic Design Category D in accordance with 780 CMR 1616.00, the requirements for Seismic Design Category C in 780 CMR 1809.2.3.2.1 shall be met, in addition to the following:

1. Requirements in ACI 318, Chapter 21, need not apply, unless specifically referenced.
2. Where the total pile length in the soil is 35 feet (10 668 mm) or less, the lateral transverse reinforcement in the ductile region shall occur through the length of the pile. Where the pile length exceeds 35 feet (10 668 mm), the ductile pile region shall be taken as the greater of 35 feet (10 668 mm) or the distance from the underside of the pile cap to the point of zero curvature plus three times the least pile dimension.
3. In the ductile region, the center-to-center spacing of the spirals or hoop reinforcement shall not exceed one-fifth of the least pile dimension, six times the diameter of the longitudinal strand, or eight inches (203 mm), whichever is smaller.
4. Circular spiral reinforcement shall be spliced by lapping one full turn and bending the end of the spiral to a 90-degree hook or by use of a mechanical or welded splice complying with Sect. 12.14.3 of ACI 318.
5. Where the transverse reinforcement consists of circular spirals, the volumetric ratio of spiral transverse reinforcement in the ductile region shall comply with the following:

EQUATION 18-5

$$\rho_s = 0.25(f'_c/f_{yh})(A_g/A_{ch} - 1.0)[0.5 + 1.4P/(f'_c A_g)]$$

but not less than:

EQUATION 18-6

$$\rho_s = 0.12(f'_c/f_{yh})[0.5 + 1.4P/(f'_c A_g)]$$

and need not exceed:

EQUATION 18-7

$$\rho_s = 0.021$$

where:

A_g = Pile cross-sectional area, square inches (mm^2).

A_{ch} = Core area defined by spiral outside diameter, square inches (mm^2).

f'_c = Specified compressive strength of concrete, psi (MPa).

f_{yh} = Yield strength of spiral reinforcement ≤ 85,000 psi (586 MPa).

P = Axial load on pile, pounds (kN), as determined from Equations 16-5 and 16-6.

ρ_s = Volumetric ratio (vol. spiral/ vol. core).

This required amount of spiral reinforcement is permitted to be obtained by providing an inner and outer spiral.

6. When transverse reinforcement consists of rectangular hoops and cross-ties, the total cross-sectional area of lateral transverse reinforcement in the ductile region with spacings, and perpendicular to dimension, hc, shall conform to:

EQUATION 18-8

$$A_{sh} = 0.3 s h_c (f'_c/f_{yh})(A_g/A_{ch} - 1.0)[0.5 + 1.4P/(f'_c A_g)]$$

but not less than:

EQUATION 18-9

$$A_{sh} = 0.12 s h_c (f'_c/f_{yh})[0.5 + 1.4P/(f'_c A_g)]$$

where:

f_{yh} = ≤ 70,000 psi (483 MPa).

h_c = Cross-sectional dimension of pile core measured center to center of hoop reinforcement, inch (mm).

s = Spacing of transverse reinforcement measured along length of pile, inch (mm).

A_{sh} = Cross sectional area of transverse reinforcement, square inches (mm^2)

f'_c = Specified compressive strength of concrete, psi (Mpa)

The hoops and cross-ties shall be equivalent to deformed bars not less than No. 3 in size. Rectangular hoop ends shall terminate at a corner with seismic hooks.

Outside of the length of the pile requiring transverse confinement reinforcing, the spiral or hoop reinforcing with a volumetric ratio not less than one-half of that required for transverse confinement reinforcing shall be provided.

1809.2.3.3 Allowable Stresses. The maximum allowable design compressive stress, f_c, in concrete shall be determined as follows:

EQUATION 18-10

$f_c = 0.33 f'_c - 0.27 f_{pc,}$ but not greater than 1600 psi (11.0 MPa)

where:

f'_c = The 28-day specified compressive strength of the concrete.

f_{pc} = The effective prestress stress on the gross section.

1809.2.3.4 Installation. A prestressed pile shall not be driven before the concrete has attained a compressive strength of at least 75% of the 28-day specified compressive strength (f'_c), but not less than the strength sufficient to withstand handling and driving forces.

1809.2.3.5 Concrete Cover. Prestressing steel and pile reinforcement shall have a concrete cover of not less than 1¼ inches (32 mm) for square piles of 12 inches (305 mm) or smaller size and 1½ inches (38 mm) for larger piles, except that for piles exposed to sea water, the minimum protective concrete cover shall not be less than 2½ inches (64 mm).

1809.3 Structural Steel Piles. Structural steel piles shall conform to the requirements of 780 CMR 1809.3.1 through 1809.3.4.

1809.3.1 Materials. Structural steel piles, steel pipe and fully welded steel piles fabricated from plates shall conform to ASTM A 36, A 252, A 283, A 572, A 588 or A 913.

1809.3.2 Allowable Stresses. The allowable design compressive stress shall not exceed 35% of the minimum specified yield strength of the steel nor 12,600 psi (86.9 Mpa).

Exception. Where justified in accordance with 780 CMR 1808.2.10, the allowable axial stress is permitted to be increased above $0.35F_y$, but shall not exceed $0.5F_y$.

1809.3.3 Dimensions and Tip Reinforcement of H-piles. Sections of H-piles shall comply with the following:

1. The flange projections shall not exceed 14 times the minimum thickness of metal in either the flange or the web and the flange widths shall not be less than 80% of the depth of the section.
2. The nominal depth in the direction of the web shall not be less than eight inches (203 mm).
3. Flanges and web shall have a minimum nominal thickness of ⅜ inch (9.5 mm).

1809.3.3.1 Tip reinforcement. The tips of all steel H piles having a thickness of metal less than 0.5 in. (12.7 mm) which are driven to end bearing on rock of Classes 1 through 3 by an impact hammer shall be reinforced. The installation of all steel H piles by impact hammer to end bearing on rock of Classes 1 through 3 shall be conducted so as to terminate driving when the pile reaches refusal on the rock surface.

1809.3.4 Dimensions of Steel Pipe Piles. Steel pipe piles driven open ended shall have a nominal outside diameter of not less than 8 inches (203 mm). The pipe shall have a minimum of 0.34 square inch (219 mm^2) of steel in cross section to resist each 1,000 foot-pounds (1356 N-m) of pile hammer energy or the equivalent strength for steels having a yield strength greater than 35,000 psi (241 MPa). Where pipe wall thickness less than 0.188 inch (4.8 mm) is driven open-ended, a suitable cutting shoe shall be provided.

780 CMR 1810.0 CAST-IN-PLACE CONCRETE PILE FOUNDATIONS

1810.1 General. The materials, reinforcement and installation of cast-in-place concrete piles shall conform to 780 CMR 1810.

1810.1.1 Material. All concrete shall have a 28-day specified compressive strength ($f'c$) of not less than 3,000 psi (20.7 MPa). The maximum size of coarse aggregate for all concrete shall be ¾ inch (19 mm), and the concrete shall have a slump of four to seven inches (102 mm to 178 mm). If concrete is to be pumped, the mix design including slump shall be adjusted to produce a pumpable concrete.

1810.1.2 Reinforcement. Except for steel dowels embedded five feet (1524 mm) or less in the pile and as provided in 780 CMR 1810.3.4, reinforcement where required shall be assembled and tied together and shall be placed in the pile as a unit before the reinforced portion of the pile is filled with concrete except in augered uncased cast-in-place piles. Tied reinforcement in augered uncased cast-in-place piles shall be placed after piles are concreted, while the concrete is still in a semifluid state.

1810.1.2.1 Seismic Reinforcement in Seismic Design Category C. Where a structure is assigned to Seismic Design Category C in accordance with 780 CMR 1616.0, the following shall apply. A minimum longitudinal reinforcement ratio of 0.0025 shall be provided in the top ⅓ of the pile length or the length determined by analysis, but not less than ten feet (3048 mm) below the ground. The reinforcing shall be a minimum of four longitudinal bars, with closed ties of a minimum ¼ inch (6 mm) diameter provided at 16-longitudinal-bar-diameter maximum spacing, or with equivalent spirals. Within a distance below the bottom of the pile cap equal to three times the least pile dimension, transverse confinement reinforcing shall have a maximum spacing of six inches (152 mm) or eight-longitudinal-bar-diameters, whichever is less.

1810.1.2.2 Seismic Reinforcement in Seismic Design Category D. Where a structure is assigned to Seismic Design Category D in accordance with 780 CMR 1616, the requirements for Seismic Design Category C given above shall be met, in addition to the following. A minimum longitudinal reinforcement ratio of 0.005 shall be provided in the top ½ f of the pile length, a minimum of ten ft below the ground, or throughout the flexural length of the pile, whichever length is greatest. The flexural length shall be taken as the length of the pile to a point where the concrete section cracking moment strength multiplied by 0.4 exceeds the required moment strength at that point. The reinforcing shall be a minimum of four longitudinal bars with transverse confinement reinforcing provided in the pile in accordance with Sections 21.4.4.1, 21.4.4.2, and 21.4.4.3 of ACI 318 within a distance below the bottom of the pile cap equal to three times the least pile dimension. It shall be permitted to use a transverse spiral reinforcing ratio of not less than ½ of that required in Section 21.4.4.1(a) of ACI 318 for other than Class E, F, or liquefiable sites. Tie spacing throughout the remainder of the concrete section shall not exceed 12-longitudinal-bar-diameters, one-half the least dimension of the section, nor 12 inches (305 mm). Ties shall be a minimum of No. 3 bars for piles with a least dimension up to 20 inches (508 mm), and No. 4 bars for larger piles.

Exception. Confinement by ties or spirals is not required where permanent metal casing (steel pipe, steel tube or spiral-welded steel shell) is used, provided the casing has minimum thickness as follows: for Seismic Performance Category C structures, 0.058 inch (1.5 mm), and for Seismic Performance Category D structures, 0.070 inch (1.8mm). The steel casing must be adequately protected from corrosion due to soil, changing water levels or other subsurface conditions indicated by the site soil investigation.

1810.1.3 Concrete Placement. For all cased piles, the inside of the pipe or casing shall be thoroughly cleaned to the bottom and visually inspected prior to filling with concrete. Concrete shall be placed in such a manner as to ensure the exclusion of any foreign matter and to secure a full-sized shaft. The concreting shall be subject to the following limitations:

1. The diameter shall not vary more than 20% from the specified value.
2. Concrete shall not be placed through water except where tremie methods are approved.
3. When depositing concrete from the top of the pile, the concrete flow shall be rapid and continuous through a funnel hopper centered at the top of the pile.
4. After filling with concrete, the top ten feet (3 m) shall be thoroughly rodded.
5. No pile shall be installed within a distance of nine feet (2.7 m) from a pile which has been filled with concrete for less than 12 hours, unless approved.

1810.2 Enlarged Base Piles. Enlarged base piles shall conform to the requirements of 780 CMR 1810.2.1 through 1810.2.5.

1810.2.1 Materials. The maximum size for coarse aggregate for concrete shall be ¾ inch (19.1 mm). Concrete to be compacted shall have a zero slump.

1810.2.2 Allowable Stresses. The maximum allowable design stress on shaft concrete shall be 33% of the 28-day strength, but not exceeding 1,600 psi (11.0 MPa). The maximum allowable design stress on permanent steel casing, if at least 1/10-inch (2.5 mm) thick, and on steel reinforcing shall be 40% of the minimum specified yield strength, but not exceeding 24,000 psi (165 Mpa).

1810.2.3 Installation. Enlarged bases formed either by compacting concrete or driving a precast base shall be formed in or driven into granular soils. Piles shall be constructed in the same manner as successful prototype test piles driven for the project. Pile shafts extending through peat or other organic soil shall be encased in a permanent steel casing. Where a cased shaft is used, the shaft shall be adequately reinforced to resist column action or the annular space around the pile shaft shall be filled sufficiently to re-establish lateral support by the soil. The installation of enlarged base piles having compacted concrete bases shall fulfill the following requirements:

1810.2.3.1 Base.

1. The enlarged base shall be formed on or in bearing materials of Classes 1 to 9 inclusive. The Class 9 material (fine sand) shall have a maximum of 15% by weight finer than the No. 200 mesh sieve and shall be non-plastic, unless satisfactory load test results or other substantiating data are submitted to, and approved by, the building official.

2. The compacted concrete placement shall be in measured batches, to establish impact energy required per unit volume of concrete. A minimum of one Standard Batch Volume of concrete, as defined in Table 1810.4, shall be injected in the base, after expulsion of the concrete plug or boot used to close the tube during the driving process.

1810.2.3.2 Shaft Installation.

1810.2.3.2.1 Uncased Compacted-concrete Shaft.

1. Concrete shall be placed at zero slump, in small batches, and shall be compacted in place in a controlled manner as the drive-tube is withdrawn.
2. Enlarged base piles formed through soils of Classes 10 and 11, located less than nine feet or within the heave range from an uncased shaft, shall be pre-drilled through such soil.
3. An uncased compacted-concrete shaft shall not be formed through very soft to soft soils of Classes 10 and 11. The building official may waive this requirement based upon satisfactory evidence prepared by a registered design professional that the soil has sufficient strength for proper shaft construction.
4. A suitable method shall be employed by the contractor and the design professional to verify and record that the entire length of the shaft is completely filled with concrete. Such means shall include the ability to determine the incremental volume of concrete installed in relation to the calculated shaft volume.

1810.2.3.2.2 Uncased High-slump Concrete Shaft.

1. Concrete shall be placed at not less than eight-inch slump, except that slump as low as four inches may be allowed if adequate vibration is applied to the drive-tube during the entire withdrawal process. During withdrawal, the level of concrete within the tube shall have a positive differential head over external soil and water pressures at all times.
2. The shaft shall be provided with full-length reinforcing steel anchored in the enlarged base. At a minimum, provide a cage with four, full length, number five reinforcing bars evenly spaced near the shaft perimeter.
3. Enlarged base piles located less than nine feet (2.7 m) from a completed uncased high-slump shaft shall not be installed until at least 12 hours after shaft pour.
4. A suitable method shall be employed by the contractor and the design professional to verify and record that the entire length of the shaft is completely filled with concrete. Such means shall include the ability to determine the incremental volume of concrete installed in relation to the calculated shaft volume.

1810.2.3.2.3 Cased Shaft. The permanent metal casing shall be fastened to the enlarged base in such a manner that the two will not separate.

1810.2.4 Load-bearing Capacity. Load-bearing capacity shall be verified by load tests in accordance with 780 CMR 1808.2.8.2.4.

1. For enlarged base piles with compacted concrete bases and loads up to 120 tons, the allowable load may be computed by the following formula:

$$R = [(B \times E)/C]\ V^{2/3}$$

where:

R = allowable load in pounds;

B = average number of blows required to inject one cubic foot of concrete, during injection of the last batch;

E = Energy per blow in foot-pounds;

C = constant; and

V = total volume of base concrete in cubic feet.

The values of R, E, and C shall conform to Table 1810.2.4 unless other values are determined by load test, in which case the latter values shall control. Use of Table 1810.2.4 is limited by the provisions of 780 CMR 1808.2.8.2.2.

The value of V shall include an allowance of one Standard Batch Volume of concrete, if concrete is used in the tube during the driving process, plus the additional volume of concrete injected during formation of the base.

2. During injection of the last batch of concrete in the base, the height of concrete within the drive tube shall not be more than a of the drive-tube inside diameter.

TABLE 1810.2.4

R (tons)	Energy, E (foot-pounds)	C	Standard Batch Volume (cubic feet)
over 100	140,000	18	5
51 to 100	100,000	18	5
25 to 50	60,000	30	2

1810.2.5 Concrete Cover. The minimum concrete cover shall be 2½ inches (64 mm) for uncased shafts and one inch (25 mm) for cased shafts.

1810.2.6 Seismic Reinforcement. Where a structure is assigned to Seismic Design Category C or D in accordance with 780 CMR 1616.0, the corresponding requirements of 780 CMR 1810.1.2.1 and 1810.1.2.2 shall be met.

1810.2.7 Spacing. The center-to-center spacing with uncased shafts shall be not less than 2.5 times the outside diameter of the drive tube and not less than 3.5 feet. The center-to-center spacing with cased shafts shall be not less than 3.0 times the shaft diameter.

1810.2.8 Loading on Underlying Strata. Where the bearing stratum is underlain by weaker material, or if the bearing stratum becomes weaker with depth, the vertical pressure on the underlying weaker material shall not exceed the allowable bearing pressure of the weaker material determined in accordance with 780 CMR 1804.3. The vertical pressure can be computed by assuming that the load is spread uniformly at an angle of 30 degrees with the vertical, starting at a polygon circumscribing the pile or pile group at the junction of the shaft and enlarged base, but not extending beyond intersecting 30 degree planes from adjacent piles or pile groups.

1810.3 Augered Uncased Piles. Augered uncased piles shall conform to 780 CMR 1810.3.1 through 1810.3.5.

1810.3.1 Allowable Stresses. The design stresses shall not exceed the following values:

1. For compression loads. The maximum allowable design stress on the cement grout or concrete shall be 33% of the specified 28- day unconfined compressive strength, but not exceeding 1,600 psi (11.0 MPa). The maximum allowable design stress on the steel reinforcing shall be 40% of the minimum specified yield strength, but not exceeding 24,000 psi (165 MPa).
2. For tension loads. The maximum allowable design tensile stress on the steel reinforcing shall be 60% of the minimum specified yield strength. The allowable design tensile stress on the cement grout shall be zero.

1810.3.2 Dimensions. An augered uncased pile is defined as a structural member installed utilizing a hollow-stem auger no less than 12 inches (305 mm) in outside diameter which extends to satisfactory bearing materials to develop support by end bearing and/or friction in those materials. The design pile diameter shall be taken as the outside diameter of the hollow stem auger. The minimum center-to-center spacing between adjacent piles shall not be less than 30 inches (760 mm) or two times the pile diameter, whichever is greater. In addition, for groups of friction piles, the overall circumference of a pile group shall exceed the sum of the circumferences of all of the individual piles within the group.

1810.3.3 Installation. Augered uncased piles shall be formed by advancing a closed-end continuous-flight hollow-stem auger of uniform diameter through unsuitable material and into a satisfactory bearing material followed by removal of the tip closure and pumping cement grout or concrete through the hollow-stem while the hollow-stem auger is extracted. During advancement, the hollow-stem auger shall be rotated rapidly such that the material through which the auger is being advanced is removed by the auger flights and is not displaced laterally by the auger. During withdrawal, if the hollow stem auger is rotated, it shall be rotated in a positive (advancing) direction.

1. The grout or concrete shall be pumped under continuous pressure and in one continuous operation. Grout or concrete pump pressures shall be measured and maintained at all times sufficiently high to offset hydrostatic and lateral earth pressures. The rate of withdrawal of the auger shall be carefully controlled to exclude all foreign matter and ensure that the augered hole is completely filled with grout or concrete as the auger is withdrawn. The actual volume of grout or concrete pumped into each hole shall be equal to, or greater than, the theoretical volume of the augered hole.
2. If the grouting or concreting process of any pile is interrupted, or a loss of concreting pressure occurs, the pile shall be redrilled to its original depth plus six inches (152 mm) (unless bearing on rock) and filled from the bottom.
3. Augered uncased piles shall not be installed within six pile diameters (center-to-center) of a pile filled with grout or concrete less than 24-hours old except where approved by the registered design professional.

1810.3.3.1 Records. The owner shall engage a registered design professional to monitor the installation of augered uncased piles in accordance with 780 CMR 1808.2.22. The design professional or his representative shall make an accurate record of the installation equipment used, pile dimensions, grout or concrete volumes, reinforcement, interruptions or delays in pile installation, and all other pertinent installation data.

1810.3.3.2 Instrumentation. The continuous-flight auger rig utilized to install augered uncased piles shall be equipped with data logging equipment that automatically monitors and produces a real-time printout of depth, grout or concrete pressure, grout or concrete flow, and rate of auger withdrawal. The automatic monitoring equipment shall immediately indicate to the equipment operator, and record on the printed record, any instance during the withdrawal of the hollow-stem auger where the rate of auger withdrawal times the theoretical pile cross-sectional area exceeds the rate of grout or concrete placement. Printed instrumentation readout for each pile shall be provided to the design professional's representative upon completion of each pile.

1810.3.4 Reinforcement. Where full length longitudinal steel reinforcement is placed without lateral ties, the reinforcement shall be placed through the hollow stem of the auger prior to filling the pile with concrete. All pile reinforcement shall have a concrete cover of not less than 2.5 inches (64 mm).

Exception. Where physical constraints do not allow the placement of the longitudinal reinforcement prior to filling the pile with concrete or where partial length longitudinal reinforcement is placed without lateral ties, the reinforcement is allowed to be placed after the piles are completely concreted but while concrete is still in a semi-fluid state.

1810.3.5 Seismic Reinforcement. Where a structure is assigned to Seismic Design Category C or D in accordance with 780 CMR 1616.0, the corresponding requirements of 780 CMR 1810.1.2.1 and 1810.1.2.2 shall be met.

1810.4 Driven Uncased Piles. No provisions.

1810.5 Steel-cased Piles. Steel-cased piles shall comply with the requirements of 780 CMR 1810.5.1 through 1810.5.4.

1810.5.1 Materials. Pile shells or casings shall be of steel and shall be sufficiently strong to resist collapse and sufficiently watertight to exclude any foreign materials during the placing of concrete. Steel shells shall have a sealed tip with a diameter of not less than eight inches (203 mm). Concrete shall satisfy the provisions of 780 CMR 1810.1.1. The shape of the pile may be cylindrical, or conical, or a combination thereof, or it may be a succession of cylinders of equal length, with the change in diameter of adjoining cylinders not exceeding one inch.

1810.5.2 Allowable Stresses. The allowable design compressive stress in the concrete shall not exceed 33% of the 28-day specified compressive strength (f'_c), nor 1,600 psi (11.0 MPa). The allowable concrete compressive stress shall be 0.40 (f'_c) for that portion of the pile meeting the following conditions.

1810.5.2.1 Shell Thickness. The thickness of the steel shell shall not be less than manufacturer's standard gage No. 14 gage (0.068 inch) (1.75 mm) minimum.

1810.5.2.2 Shell Type. The shell shall be seamless or shall be provided with seams of strength equal to the basic material and be of a configuration that will provide confinement to the cast-in-place concrete.

1810.5.2.3 Strength. The ratio of steel yield strength (f_y) to 28-day specified compressive strength ($f?'_c$) shall not be less than six.

1810.5.2.4 Diameter. The nominal pile diameter shall not be greater than 16 inches (406 mm).

The load on cased poured concrete piles shall be applied to the cross-sectional area computed on the following basis:

1. For metal-cased piles driven to and into materials of Classes 1 through 4, using the diameter measured one foot (0.3 m) above the point, except that when the rock is immediately overlain by a bearing stratum consisting of one or a combination of bearing materials of Classes 5, 6, and 7, using the diameter at the surface of the bearing stratum.
2. For metal-cased piles, driven through compressible materials including Classes 10 and 11 and into a bearing stratum consisting of one or a combination of bearing materials of Classes 5 through 9, using the diameter at the surface of the bearing stratum.

1810.5.3 Installation. Steel shells shall be mandrel-driven their full length in contact with the surrounding soil.

Steel shells shall be driven in such order and with such spacing as to ensure against distortion of or damage to piles already in place. A pile shall not be driven within four and one-half average pile diameters of a pile filled with concrete less than 24 hours old unless approved by the registered design professional. Concrete shall not be placed in steel shells within heave range of driving. The requirements of 780 CMR 1810.1.3 shall apply.

1810.5.4 Reinforcement. Reinforcement shall not be placed within one inch (25 mm) of the steel shell. Reinforcing shall be required for unsupported pile lengths or where the pile is designed to resist uplift or unbalanced lateral loads.

1810.5.4.1 Seismic Reinforcement. Where a structure is assigned to Seismic Design Category C or D in accordance with 780 CMR 1616.0, the corresponding requirements of 780 CMR 1810.1.2.1 and 1810.1.2.2 shall apply.

1810.6 Concrete-filled Steel Pipe and Tube Piles. Concrete-filled steel pipe and tube piles shall conform to the requirements of 780 CMR 1810.6.1 through 1810.6.5.

1810.6.1 Materials. Steel pipe and tube sections used for piles shall conform to ASTM A 252 or A 283. Concrete shall conform to 780 CMR 1810.1.1. The maximum coarse aggregate size shall be 0.75 inch (19.1 mm).

1810.6.2 Allowable Stresses. The allowable design compressive stresses shall not exceed the values indicated in 780 CMR 1810.6.2.1 through 1810.6.2.3.

1810.6.2.1 Top Driven Piles. The allowable design compressive stress in the concrete shall not exceed 25% of the 28-day compressive strength of the concrete or 1,100 psi (7.6 MPa), whichever is smaller. The maximum allowable compressive stress in the steel shall not exceed 9,000 psi (62 Mpa).

1810.6.2.2 Mandrel Driven Piles. For piles installed with mandrels which transmit driving stresses directly to the bottom of the steel pipe, the allowable design compressive stress in the concrete shall not exceed 33% of the 28-day specified compressive strength. The allowable design compressive stress in the steel shall not exceed 35% of the minimum specified yield strength of the steel.

1810.6.2.3 The maximum allowable design stress in the steel shall be limited to 50% of the minimum specified yield strength where higher stresses are substantiated in accordance with 780 CMR 1808.2.10.

1810.6.3 Minimum Dimensions. Piles shall have a nominal outside diameter of not less than 8 inches (203 mm) and a minimum wall thickness in accordance with 780 CMR 1809.3.4. For mandrel-driven pipe piles, the minimum wall thickness shall be 0.1 inch (2.5 mm).

1810.6.4 Reinforcement. Reinforcement steel shall conform to 780 CMR 1810.1.2. Reinforcement shall not be placed within 1 inch (25 mm) of the steel casing.

1810.6.4.1 Seismic Reinforcement. Where a structure is assigned to Seismic Design Category C or D in accordance with 780 CMR 1616, the following shall apply. Minimum reinforcement no less than 0.01 times the cross-sectional area of the pile concrete shall be provided in the top of the pile with a length equal to two times the required cap embedment anchorage into the pile cap, but not less than the tension development length of the reinforcement. The wall thickness of the steel pipe shall not be less than 0.188 inch (4.75 mm).

1810.6.5 Placing Concrete. The placement of concrete shall conform to 780 CMR 1810.1.3.

1810.7 Caisson Piles. Caisson piles shall conform to the requirements of 780 CMR 1810.7.1 through 1810.7.8.

1810.7.1 Construction. Caisson piles shall consist of a shaft section of concrete-filled pipe extending to bedrock of Classes 1 or 2 with an uncased socket drilled into the bedrock and filled with concrete. The caisson pile shall have a full-length structural steel core or a stub core installed in the rock socket and extending into the pipe portion a distance equal to the socket depth.

1810.7.2 Materials. Pipe and steel cores shall conform to the material requirements in 780 CMR 1808.3. Pipes shall have a minimum wall thickness of 0.375 inch (9.5 mm) and shall be fitted with a suitable steel-driving shoe welded to the bottom of the pipe. Concrete shall have a 28-day specified compressive strength (f'_c) of not less than 4,000 psi (27.58 MPa). The concrete mix shall be designed and proportioned so as to produce a cohesive workable mix with a slump of four inches (102 mm) to six inches (152 mm).

1810.7.3 Design. The depth of the rock socket shall be sufficient to develop the full load-bearing capacity of the caisson pile with a minimum safety factor of two, but the depth shall not be less than the outside diameter of the pipe. The design of the rock socket is permitted to be predicated on the sum of the allowable load-bearing pressure on the bottom of the socket plus bond along the sides of the socket. The socket design stress shall be determined by a registered design professional based upon foundation investigation study in accordance with 780 CMR 1802, but in no case will the design bond stress on the perimeter of the socket exceed 200 psi. Load tests, in accordance with 780 CMR 1808.2.8.2.4, may be required if foundation investigation data are judged insufficient by the registered design professional to verify the selected bond stress.

The minimum outside diameter of the caisson pile shall be 18 inches (457 mm), and the diameter of the rock socket shall be approximately equal to the inside diameter of the pile.

1810.7.4 Structural Core. The gross cross-sectional area of the structural steel core shall not exceed 25% of the gross area of the caisson. The minimum clearance between the structural core and the pipe shall be two inches (51 mm). Where cores are to be spliced, the ends shall be milled or ground to provide full contact and shall be full-depth welded.

1810.7.5 Allowable Stresses. The allowable design compressive stresses shall not exceed the following: concrete, 0.33 f'_c; steel pipe, 0.35 F_y; and structural steel core, 0.50 F_y.

1810.7.6 Installation. The rock socket and pile shall be thoroughly cleaned of foreign materials before filling with concrete. Steel cores shall be bedded in cement grout at the base of the rock socket. Concrete shall not be placed through water except where a tremie or other approved method is used.

1810.7.7 Seismic Reinforcement. Caisson piles shall meet the seismic reinforcement requirements of 780 CMR 1810.6.4.1.

1810.7.8 Spacing. The minimum center to center spacing shall be not less than 2.5 times the outside diameter of the steel shell.

1810.8 Small Diameter Grouted Piles.

1810.8.1 General. 780 CMR 1810.8 covers grouted cast-in-place piles which are less than 12 inches (305 mm) in diameter and in which all or a portion of the pile is cast directly against the soil without permanent casing.

1810.8.2 Materials. Concrete or sand-cement grout shall satisfy the provisions of 780 CMR 1810.1.1.

1810.8.3 Allowable Stresses. The design stresses shall not exceed the following values:

1. For compression loads. The maximum allowable design stress on the cement grout or concrete shall be 33% of the specified 28- day unconfined compressive strength, but not exceeding 1,600 psi (11.0 MPa). The maximum allowable design stress on the steel reinforcing, including permanent steel casing, shall be 40% of the minimum specified yield strength. Where the design of the pile cross section includes compression on grout that is not confined within a permanent steel casing or bedrock, the allowable stress on the steel shall not exceed 24,000 psi (165 MPa).
2. For tension loads. The maximum allowable design tensile stress on the steel reinforcing shall be 60% of the minimum specified yield strength. The allowable design tensile stress on the cement grout shall be zero.

1810.8.4 Minimum Reinforcing. The steel reinforcing shall be designed to carry the following minimum percentage of the design compression load:

1. For a pile or a portion of a pile that is grouted inside a drilled temporary casing or a permanent casing, grouted inside a hole drilled into stable rock, or grouted with a hollow-stem auger, the reinforcing steel shall be designed to carry not less than 40% of the design compression load.
2. For a pile or a portion of a pile that is grouted in an uncased drill hole in materials other than stable rock, or grouted in a driven temporary casing, the pile shall be designed to carry the entire design compression load on the reinforcing steel.

Exception. Where a portion of the cement grout is placed and permanently enclosed within permanent steel casing or reinforcing consisting of steel pipe, that portion may be included at the allowable stress for the grout.

1810.8.5 Load Test. For all design loads, the allowable load shall be determined by load tests in accordance with 780 CMR 1808.2.8.2.4. Load tests may be waived by the code official based on substantiating data and analyses prepared by a registered design professional.

1810.8.5.1 Alternative Load Test Procedure for Friction Piles. For piles designed as friction piles, the friction capacity in compression may be verified by load testing in tension. The tension load test shall be performed in accordance with 780 CMR 1808.2.8.2.6.

Exceptions:

1. The test pile must be cased or left ungrouted down to the top of the bearing stratum in a manner which will ensure that no friction resistance is developed above the bearing stratum.
2. The maximum design load shall be taken as 50% of the applied test load which results in a movement under load of 0.5 inch (13 mm) at the pile tip. The movement at the pile tip shall be:
   (a) measured directly by a tell-tale or
   (b) computed by deducting the theoretical elastic elongation of the pile from the displacement measured at the top of the pile.

1810.8.6 Installation. The pile may be formed in a hole advanced by rotary or rotary percussive drilling methods (with or without temporary casing), by a hollow-stem auger, or by driving a temporary casing. The pile shall be grouted with a fluid cement grout. The grout shall be pumped through a tremie pipe extending to the bottom of the pile until grout of suitable quality returns at the top of the pile. The following requirements apply to specific installation methods:

1. Piles grouted with temporary casing. For piles grouted inside a temporary casing, the reinforcing steel shall be inserted prior to withdrawal of the casing. The casing shall be withdrawn in a controlled manner with the grout level maintained at the top of the pile, to ensure that the grout completely fills the drill hole. During withdrawal of the casing, the grout level inside the casing shall be monitored to check that the flow of grout inside the casing is not obstructed.

2. Piles grouted without temporary casing. For a pile or portion of a pile grouted in an open drill hole in soil without temporary casing, the minimum design diameter of the drill hole shall be verified by a suitable device immediately prior to grouting. The reinforcing steel shall be inserted prior to grouting.
3. Piles grouted with hollow-stem augers. For piles installed with a hollow-stem auger, the grout shall be pumped under continuous pressure, and the rate of withdrawal of the auger shall be carefully controlled to ensure that the hole is completely filled with grout as the auger is withdrawn. The actual volume of grout pumped for each 1.0 foot (305 mm) of withdrawal of the auger shall be recorded and must be equal to or greater than the theoretical volume. The reinforcing steel shall be inserted prior to withdrawal of the auger.
4. For piles designed for end bearing, a suitable means shall be employed to verify that the bearing surface is properly cleaned prior to grouting.
5. Subsequent piles shall not be drilled or driven near piles that have been grouted until the grout has had sufficient time to harden.

1810.8.7 Pile Diameter. The design pile diameter shall be taken as:

1. The outside diameter of the temporary casing; or
2. The diameter of a full circumferential drill bit attached to the bottom of the temporary casing; or
3. The outside diameter of the hollow-stem auger; or
4. The borehole diameter verified by suitable measurements made immediately prior to grouting.

1810.8.8 Corrosion Protection.

1. Where steel reinforcing is not enclosed inside a permanent casing, centralizers shall be provided on the reinforcing to ensure a minimum grout cover of 1.0 inch (25 mm) in soil and 0.5 inch (13 mm) in rock. Grout cover requirements may be reduced when the reinforcing steel is provided with a suitable protective coating.
2. Permanent steel casing that is used as structural reinforcing shall be protected in accordance with the provisions of 780 CMR 1808.2.17.
3. For piles subjected to sustained tension loading in corrosive environments, the reinforcing steel shall be protected by a suitable protective coating or encapsulation method.

1810.8.9 Buckling. For piles that extend through more than five feet of soft soil of Material Classes 10 or 11 using a solid bar section for the steel reinforcing, the lateral support assumptions of 780 CMR 1808.2.9.1 shall not apply if any of the following conditions exist:

1. Steel designed for an allowable stress greater than 24,000 psi.
2. Outside diameter of the grout less than four times the diameter of the steel reinforcing bar
3. Soil shear strength less than 200 psf

For these conditions, the potential for buckling in the soft soil zone shall be investigated.

780 CMR 1811.0 COMPOSITE PILES

1811.1 General. Composite piles shall conform to the requirements of 780 CMR 1811.2 through 1811.5.

1811.2 Design. Composite piles consisting of two or more approved pile types shall be designed to meet the conditions of installation.

1811.3 Limitation of Load. The maximum allowable load shall be limited by the capacity of the weakest section incorporated in the pile.

1811.4 Splices. Splices between concrete and steel or wood sections shall be designed to prevent separation both before and after the concrete portion has set, and to ensure the alignment and transmission of the total pile load. Splices shall be designed to resist uplift caused by upheaval during driving of adjacent piles, and shall develop the full compressive strength and not less than 50% of the tension and bending strength of the weaker section.

1811.5 Seismic Reinforcement. Where a structure is assigned to Seismic Design Category C or D in accordance with 780 CMR 1616.0, the following shall apply. Where concrete and steel are used as part of the pile assembly, the concrete reinforcement shall comply with that given in 780 CMR 1810.1.2.1 and 1810.1.2.2 or the steel section shall comply with 780 CMR 1810.6.4.1 or 1810.3.5.

780 CMR 1812. PIER FOUNDATIONS

1812.1 General. Isolated and multiple piers used as foundations shall conform to the requirements of 780 CMR 1812.2 through 1812.10, as well as the applicable provisions of 780 CMR 1808.2.

1812.2 Design. Foundation piers may be designed as concrete columns with continuous lateral support below the soil level. The unit compressive stress in the concrete shall not exceed 33% of the 28-day strength of the concrete or 1,600 psi (11.0 MPa), whichever is less. The unit compressive stress in the steel reinforcement or the permanent steel casing shall not exceed 40% of the yield strength of the steel or 24,000 psi (165 MPa), whichever is less. Permanent steel casing which is used as structural reinforcement shall be protected against corrosion in accordance with 780 CMR 1808.2.17.

1812.3 Materials. Concrete shall have a 28-day specified compressive strength (f'_c) of not less than 2,500 psi (17.24 MPa). Where concrete is placed through a funnel hopper at the top of the pier, the concrete mix shall be designed and proportioned so as to produce a cohesive workable mix having a slump of not less than four inches (102 mm) and not more than six inches (152 mm). Where concrete is to be pumped, the mix design including slump shall be adjusted to produce a pumpable concrete.

1812.4 Reinforcement. Except for steel dowels embedded five feet (1524 mm) or less in the pier, reinforcement where required shall be assembled and tied together and shall be placed in the pier hole as a unit before the reinforced portion of the pier is filled with concrete.

Exception. Reinforcement is permitted to be wet set and the 2.5 inch (64 mm) concrete cover requirement be reduced to 2 inches (51 mm) for Group R, Division 3 and Group U, Division 1 occupancies not exceeding two stories of light-frame construction, provided the construction method can be demonstrated to the satisfaction of the building official.

1812.4.1 Seismic Reinforcement. Where a structure is assigned to Seismic Design Category C or D in accordance with 780 CMR 1616, the corresponding requirements of 780 CMR 1810.1.2.1 and 1810.1.2.2 shall be met. The minimum longitudinal reinforcement ratio shall be applied to the minimum design cross-sectional area determined in accordance with 780 CMR 1812.2.

Exceptions:

1. Isolated piers supporting posts of Group R, Division 3 and Group U, Division 1 occupancies not exceeding two stories of light-frame construction is permitted to be reinforced as required by rational analysis but not less than a minimum of one No. 4 bar, without ties or spirals, when detailed so the pier is not subject to lateral loads and the soil is determined to be of adequate stiffness.
2. Isolated piers supporting posts and bracing from decks and patios appurtenant to Group R, Division 3 and Group U, Division 1 occupancies not exceeding two stories of light-frame construction may be reinforced as required by rational analysis but not less than one No. 4 bar, without ties or spirals, when the lateral load, E, to the top of the pier does not exceed 200 pounds (890 N) and the soil is determined to be of adequate stiffness.
3. Piers supporting the concrete foundation wall of Group R, Division 3 and Group U, Division 1 occupancies not exceeding two stories of light-frame construction is permitted to be reinforced as required by rational analysis but not less than two No. 4 bars, without ties or spirals, when it can be shown the concrete pier will not rupture when designed for the maximum seismic load E_m, and the soil is determined to be of adequate stiffness.
4. Closed ties or spirals where required by 780 CMR 1810.1.2, are permitted to be limited to the top 3 feet (914 mm) of the piers 10 feet (3048 mm) or less in depth supporting Group R, Division 3 and Group U, Division 1 occupancies of Seismic Design Category D, not exceeding two stories of light-frame construction.

1812.5 Concrete Placement. Concrete may be dropped into the pier from the ground surface provided no more than 3.0 inches (76 mm) of water remains in the bottom and the concrete will free-fall vertically without obstruction. The concrete shall be placed in a rapid, continuous operation and controlled such that the concrete does not segregate.

1. No piers shall be installed near a concreted pier until the concrete has set sufficiently to avoid damage to the concreted pier.
2. For piers without belled bases, concrete or grout may be placed through still water or slurry. A properly operated tremie or pumping method shall be used. Samples of the slurry shall be tested to determine the properties prior to placing concrete in each pier. The quality, consistency, and density of the slurry shall be controlled to ensure that there will be free-flow of concrete from the tremie pipe. The concrete must be placed such that all water, slurry and contaminated concrete below design cutoff level is displaced.
3. For piers with belled bases, the concrete may be placed under slurry, based upon the recommendations of a registered design professional and with the approval of the building official. The specific soil or rock conditions, equipment and procedures used shall be taken into account.
4. A suitable method shall be employed to verify that the entire length of the shaft is completely filled with concrete. Such means shall include the ability to determine the incremental volumes of concrete installed in relation to calculated shaft volume.

1812.6 Belled Bases. Where pier foundations are belled at the bottom, the edge thickness of the bell shall not be less than four inches (102 mm). Where the sides of the bell slope at an angle less than 60 degrees (1 rad) from the horizontal, the effects of vertical shear shall be considered.

1812.7 Laterally Unsupported Piers. Where adequate lateral support is not provided, and the unsupported height to least lateral dimension does not exceed three, piers of plain concrete shall be designed and constructed as pilasters in accordance with ACI 318. Where the unsupported height to least lateral dimension exceeds three, piers shall be constructed of reinforced concrete, and shall conform to the requirements for columns in ACI 318.

> **Exception**. Where adequate lateral support is furnished by the surrounding materials as defined in 780 CMR 1808.2.9, piers are permitted to be constructed of plain or reinforced concrete. The requirements of ACI 318 for bearing on concrete shall apply.

1812.8 Steel Shell. Where concrete piers are entirely encased with a circular steel shell, and the area of the shell steel is considered reinforcing steel, the steel shall be protected under the conditions specified in 780 CMR 1808.2.17. Horizontal joints in the shell shall be spliced to comply with 780 CMR 1808.2.7.

1812.9 Installation. Where piers are carried to depths below water level, the piers shall be constructed by a method that will ensure accurate preparation and inspection of the bottom, and the depositing or construction of sound concrete. In unstable soils, temporary casing or slurry shall be used to stabilize the excavation. When slurry is used to stabilize the excavation, the level and quality of the slurry shall be monitored and controlled to maintain stability of the shaft and the bearing surface.

1812.10 Alignment. When the center of the cross section of a foundation pier at any level deviates from the resultant of all forces more than 2 % of its height, or more than 10% of its diameter, it shall be reinforced as provided in ACI 336. The restraining effect of the surrounding soil may be taken into account.

1812.11 Minimum Spacing. The minimum center-to-center spacing between adjacent piers designed for friction support shall be not less than 2.0 times the shaft diameter.

1812.12 Special Provisions. For piers with shaft diameter less than 24 inches (610 mm), the following special provisions shall apply:

1. For piers with temporary casing extending to the bottom, the concrete may be poured from the top in accordance with 780 CMR 1812.5.
2. For all other cases, piers shall be filled from the bottom upward through a tremie or concrete pump tube in accordance with 780 CMR 1812.5(2).

780 CMR 19.00

CONCRETE

780 CMR 19.00 is Unique to Massachusetts

780 CMR 1901.0 GENERAL

1901.1 General. Structural concrete shall be designed and constructed in accordance with ACI 318, including all its appendices, except as provided otherwise in 780 CMR 19.00.

780 CMR 1902.0 THROUGH 1907.0 - RESERVED

780 CMR 1908.0 MODIFICATIONS TO ACI 318

1908.1 General. The text of ACI 318 shall be modified as indicated in 780 CMR 1908.1.1 through 1908.1.8

1908.1.1 ACI 318, Section 21.1. Modify existing definitions and add the following definitions to ACI 318, Section 21.1.

DESIGN DISPLACEMENT. Total lateral displacement expected for the design-basis earthquake, as specified by ASCE 7, Section 9.5.5.7 as modified by 780 CMR 1615.0.

STORY DRIFT RATIO. The design displacement over a story divided by the story height.

WALL PIER. A wall segment with a horizontal length-to-thickness ratio of at least 2.5, but not exceeding six, whose clear height is at least two times its horizontal length.

1908.1.2 ACI 318, Section 21.2.1. Modify Sections 21.2.1.2, 21.2.1.3 and 21.2.1.4. to read as follows:

21.2.1.2 For structures assigned to Seismic Design Category A or B, provisions of Chapters 1 through 18 and 22 shall apply except as modified by the provisions of this chapter. Where the seismic design loads are computed using provisions for intermediate or special concrete systems, the requirements of Chapter 21 for intermediate or special systems, as applicable, shall be satisfied.

21.2.1.3 For structures assigned to Seismic Design Category C, intermediate or special moment frames, or ordinary or special reinforced concrete structural walls shall be used to resist seismic forces induced by earthquake motions. Where the design seismic loads are computed using provisions for intermediate or special concrete systems, the requirements of Chapter 21 for intermediate or special systems, as applicable, shall be satisfied.

21.2.1.4 For structures assigned to Seismic Design Category D, special moment frames, special reinforced concrete structural walls, diaphragms and trusses and foundations complying with Sections 21.2 through 21.10 shall be used to resist forces induced by earthquake motions. Frame members not proportioned to resist earthquake forces shall comply with Section 21.11.

1908.1.3 ACI 318, Section 21.2.5. Modify ACI 318, Section 21.2.5, by renumbering as Section 21.2.5.1 and adding new Sections 21.2.5.2, 21.2.5.3 and 21.2.5.4 to read as follows:

21.2.5 Reinforcement in members resisting earthquake-induced forces.

21.2.5.1 Except as permitted in Sections 21.2.5.2 through 21.2.5.4, reinforcement resisting earthquake-induced flexural and axial forces in frame members and in structural wall boundary elements shall comply with ASTM A 706. ASTM 615, Grades 40 and 60 reinforcement, shall be permitted in these members if (a) the actual yield strength based on mill tests does not exceed the specified yield strength by more than 18,000 psi (retests shall not exceed this value by more than an additional 3,000 psi), and (b) the ratio of the actual ultimate tensile strength to the actual tensile yield strength is not less than 1.25.

21.2.5.2 Prestressing steel shall be permitted in flexural members of frames, provided the average prestress, f_{pc}, calculated for an area equal to the member's shortest cross-sectional dimension multiplied by the perpendicular dimension shall be the lesser of 700 psi (4.83 MPa) or $f'_c/6$ at locations of nonlinear action where prestressing steel is used in members of frames.

21.2.5.3 Unless the seismic-force-resisting frame is qualified for use through structural testing as required by ACI T1.1, for members in which prestressing steel is used together with mild reinforcement to resist earthquake-induced forces, prestressing steel shall not provide more than one-quarter of the strength for either positive or negative moments at the nonlinear action location and shall be anchored at the exterior face of the joint or beyond.

21.2.5.4 Anchorages for tendons must be demonstrated to perform satisfactorily for seismic loadings. Anchorage assemblies shall withstand, without failure, a minimum of 50 *cycles of loading ranging between 40 and 85% of the minimum specified tensile strength of the prestressing steel.*

1908.1.4 ACI 318, Section 21.7. Modify ACI 318, Section 21.7, by adding a new Section 21.7.10 to read as follows:

21.7.10 Wall piers and wall segments.

21.7.10.1 *Wall piers not designed as a part of a special moment frame shall have transverse reinforcement designed to satisfy the requirements in Section 21.7.10.2.*

Exceptions:

1. Wall piers that satisfy Section 21.11.

2. Wall piers along a wall line within a story where other shear wall segments provide lateral support to the wall piers, and such segments have a total stiffness of at least six times the sum of the stiffness of all the wall piers.

21.7.10.2 *Transverse reinforcement shall be designed to resist the shear forces determined from Sections 21.3.4.2 and 21.4.5.1. Where the axial compressive force, including earthquake effects, is less than* $A_g f'c/20$*, transverse reinforcement in wall piers is permitted to have standard hooks at each end in lieu of hoops. Spacing of transverse reinforcement shall not exceed six inches (152 mm). Transverse reinforcement shall be extended beyond the pier clear height for at least the development length of the largest longitudinal reinforcement in the wall pier.*

21.7.10.3 *Wall segments with a horizontal length-to-thickness ratio less than 2.5 shall be designed as columns.*

1908.1.5 ACI 318, Section 21.10.1.1. Modify ACI 318, Section 21.10.1.1, to read as follows:

21.10.1.1 *Foundations resisting earthquake-induced forces or transferring earthquake-induced forces between a structure and the ground shall comply with the requirements of Section 21.10 and other applicable provisions of ACI 318 unless modified 780 CMR 18.00.*

1908.1.6 ACI 318, Section 21.11. Modify ACI Sections 21.11.1 and 21.11.2.2 and add Sections 21.11.5 through 21.11.7 as follows:

21.11.1 *Frame members assumed not to contribute to lateral resistance shall be detailed according to Section 21.11.2 or 21.11.3 depending on the magnitude of moments induced in those members when subjected to the design displacement. If effects of design displacements are not explicitly checked, it shall be permitted to apply the requirements of Section 21.11.3. Slab-column connections shall comply with Sections 21.11.5 through 21.11.7. Conformance to Section 21.11 satisfies the deformation compatibility requirements of Section 9.5.2.2.4.3 of ASCE 7.*

21.11.2.2 *Members with factored gravity axial forces exceeding* $(A_g f'_c /10)$ *shall satisfy Sections 21.4.3, 21.4.4.1(c), 21.4.4.3 and 21.4.5. The maximum longitudinal spacing of ties shall be,* s_o*, for the full column height. The spacing,* s_o*, shall not be more than six diameters of the smallest longitudinal bar enclosed or six inches (152 mm), whichever is smaller. Lap splices of longitudinal reinforcement in such members need not satisfy Section 21.4.3.2 in structures where the seismic-force-resisting system does not include special moment frames.*

21.11.5 *Reinforcement to resist punching shear shall be provided in accordance with Sections 21.11.5.1 and 21.11.5.2 at slab column connections where story drift ratio exceeds* $[0.035 - 0.05\ (V_u/\phi V_c)]$ *except that Sections 21.11.4.1 and 21.11.4.2 need not be satisfied where* $Vu/\phi V_c$ *is less than 0.2 or where the story drift ratio is less than 0.005. Vu equals the factored punching shear from gravity load excluding shear stress from unbalanced moment. Vu is calculated for the load combination 1.2D + 1.0L + 0.5S. The load factor on L is permitted to be reduced to 0.5 in accordance with Section 9.2.1(a). In no case shall shear reinforcement be less than that required in Section 11.12 for loads without consideration of seismic effects.*

21.11.5.1 *— The slab shear reinforcement shall provide* V_s *not less than* $3.5(f'c)^{1/2}$.

21.11.5.2 *— Slab shear reinforcement shall extend not less than five times the slab thickness from the face of column.*

21.11.6 *— Bottom bars or wires within the column strip shall conform to Section 13.3.8.5 except that splices shall be Class B.*

21.11.7 *— Within the effective slab width defined in Section 13.5.3.2, the ratio of non-prestressed bottom reinforcement to gross concrete area shall not be less than 0.004. Where bottom reinforcement is not required to be continuous, such reinforcement shall extend a minimum of five times the slab thickness plus one development length beyond the face of the column or shall be terminated at the slab edge with a standard hook.*

1908.1.7 ACI 318, Section 21.12.5. Add Section 21.12.5.6 and modify ACI 318, Sections 21.12.5.1, 21.12.5.2 and 21.12.5.5, to read as follows:

21.12.5.1 --- Columns shall be spirally reinforced in accordance with 7.10.4 or shall conform with 21.12.5.2 through 21.12.5.4. Sections 21.12.5.5 and 21.12.5.6 shall apply to all columns.

21.12.5.2 At both ends of the member, hoops shall be provided at spacing s_o *over a length* l_o *measured from the joint face. Spacing* s_o *shall not exceed the smallest of (a), (b), (c) and (d):*

(a) Six times the diameter of the smallest longitudinal bar enclosed;

(b) 12 times the diameter of the hoop bar;

(c) ¼ of the smallest cross-sectional dimension of the frame member;

(d) six in.

Length l_o *shall not be less than the largest of (e), (f), and (g):*

(e) One-sixth of the clear span of the member;

(f) Maximum cross-sectional dimension of the member;

(g) 18 in.

21.12.5.5 --- Joint transverse reinforcement shall conform to 11.11.2. Where transverse joint reinforcement is required, such reinforcing shall be hoops. The spacing s_o *of hoops shall not exceed the smallest of (a), (b), (c) and (d) as defined in 21.12.5.2.*

21.12.5.6 --- Mechanical splices shall conform to 21.2.6 and welded splices shall conform to 21.2.7. Lap splices of longitudinal reinforcement shall be permitted only within the center half of the member length and shall be designed as tension splices.

1908.1.8 ACI 318, Section 21.13.2. Modify ACI 318, Section 21.13.2, to read as follows:

21.13.2 In connections between wall panels, or between wall panels and the foundation, yielding shall be restricted to reinforcement.

1908.2 Table 4.2.1 of ACI 318. For the purposes of this table, severe and moderate exposures shall be defined as follows:

1. Severe exposure occurs where concrete will be in almost continuous contact with moisture prior to freezing, or where deicing salts are used. Examples are pavements, bridge decks, sidewalks, parking garages and water tanks.

2. Moderate exposure occurs where concrete will be only occasionally exposed to moisture prior to freezing, and where deicing salts are not used. Examples are certain exterior walls, beams, girders and slabs not in direct contact with soil.

780 CMR 1909.0 – RESERVED

780 CMR 1910.0 SEISMIC DESIGN PROVISIONS

1910.1 General. The design and construction of concrete components that resist seismic forces shall conform to the requirements of 780 CMR 1910.0 and to ACI 318 except as modified by 780 CMR 1908.0.

1910.2 Classification of Shear Walls. Structural concrete shear walls that resist seismic forces shall be classified in accordance with 780 CMR 1910.2.1 through 1910.2.4.

1910.2.1 Ordinary Plain Concrete Shear Walls. Ordinary plain concrete shear walls are not permitted.

1910.2.2 Detailed Plain Concrete Shear Walls. Detailed plain concrete shear walls are not permitted.

1910.2.3 Ordinary Reinforced Concrete Shear Walls. Ordinary reinforced concrete shear walls are walls conforming to the requirements of ACI 318 for ordinary reinforced concrete structural walls. Shear forces due to seismic loads in ordinary reinforced concrete shear walls and coupling beams shall be increased by 50% in all applicable load combinations.

1910.2.4 Special Reinforced Concrete Shear Walls. Special reinforced concrete shear walls are walls conforming to the requirements of ACI 318 for special reinforced concrete structural walls or special precast structural walls.

1910.3 Seismic Design Category B. Structures assigned to Seismic Design Category B, as determined in 780 CMR 16.00, shall conform to the requirements for Seismic Design Category A and to the additional requirements for Seismic Design Category B of 780 CMR 1910.3.

1910.3.1 Ordinary Moment Frames. Ordinary moment frames are not permitted.

1910.4 Seismic Design Category C. Structures assigned to Seismic Design Category C, as determined in 780 CMR 16.00, shall conform to the requirements for Seismic Design Category B and to the additional requirements for Seismic Design Category C of this Section.

1910.4.1 Seismic-force-resisting Systems. Moment frames used to resist seismic forces shall be intermediate moment frames or special moment frames. Shear walls used to resist seismic forces shall be ordinary reinforced concrete shear walls or special reinforced concrete shear walls. Ordinary reinforced concrete shear walls constructed of precast concrete elements shall comply with the additional requirements of ACI 318, Section 21.13 for intermediate precast concrete structural walls, as modified by 780 CMR 1908.1.8.

1910.4.2 Discontinuous Members. Columns supporting reactions from discontinuous stiff members, such as walls, shall be designed for the special load combinations in 780 CMR 1605.0 and shall be provided with transverse reinforcement at the spacing, s_o, as defined in ACI 318, Section 21.12.5.2 over their full height beneath the level at which the discontinuity occurs. This transverse reinforcement shall be extended above and below the column as required in ACI 318, Section 21.4.4.5.

1910.4.3 Plain Concrete. Structural plain concrete members are not permitted

1910.4.3.1 Walls. Structural plain concrete walls are not permitted.

1910.4.3.2 Footings. Isolated footings of plain concrete supporting pedestals or columns are permitted provided the projection of the footing beyond the face of the supported member does not exceed the footing thickness.

Plain concrete footings supporting walls are permitted provided that the projection of the footing beyond the face of the wall does not exceed the footing thickness. Such footings shall be provided with not less than two continuous longitudinal reinforcing bars. Bars shall not be smaller than No. 5 and shall have a total area of not less than 0.002 times the gross cross-sectional area of the footing.

Reinforcing steel dowels shall extend from the plain concrete footings into the supported pedestals, columns, or walls in accordance with Sections 21.10.2.1 and 21.10.2.3 of ACI 318.

1910.4.3.3 Pedestals. Plain concrete pedestals shall not be used to resist lateral seismic forces.

1910.5 Seismic Design Category D. Structures assigned to Seismic Design Category D, as determined in 780 CMR 16.00, shall conform to the requirements for Seismic Design Category C and to the additional requirements of 780 CMR 1910.5.

1910.5.1 Seismic-force-resisting Systems. Moment frames used to resist seismic forces shall be special moment frames. Shear walls used to resist seismic forces shall be special reinforced concrete shear walls.

1910.5.2 Frame Members Not Proportioned to Resist Forces Induced by Earthquake Motions. Frame components assumed not to contribute to lateral force resistance shall conform to ACI 318, Section 21.11 as modified by 780 CMR 1908.1.6.

780 CMR 1911.0 MINIMUM SLAB PROVISIONS

1911.1 General. The thickness of concrete floor slabs supported directly on the ground shall not be less than four inches (102 mm).

See 780 CMR 13.00 for vapor barrier requirements under the slab.

780 CMR 1912.0 - RESERVED

780 CMR 1913.0 ANCHORAGE TO CONCRETE

1913.1 Post-installed Adhesive Anchors. Post-installed adhesive anchors in structural concrete (the criteria for which are excluded from Appendix D of ACI 318 by Section D.2.2) shall comply with ICC ES AC308.

1913.2 Acceptance Criteria for Post-installed Anchors.

1913.2.1 Independent Evaluation. All post-installed anchors shall be evaluated by the ICC Evaluation Service, Inc. (ICC ES) or by other accredited independent testing agencies approved by the BBRS, for compliance with 780 CMR. The ICC ES or the independent testing agencies shall provide an evaluation report that shall be made public and readily available to the public either directly or through the manufacturer requesting the evaluation. The evaluation report shall state all limitations on use.

1913.2.2 Review by the Design Professional. The registered design professional for the structural design shall obtain and evaluate the applicable evaluation reports for the anchors specified in the structural design. Anchors shall not be specified for use beyond the limitations given in the evaluation report.

780 CMR 1914.0 SHOTCRETE

1914.1 General. Shotcrete is mortar or concrete that is pneumatically projected at high velocity onto a surface. Except as specified in this section, shotcrete shall conform to the requirements of this chapter for plain or reinforced concrete.

1914.2 Proportions and Materials. Shotcrete proportions shall be selected that allow suitable placement procedures using the delivery equipment selected and shall result in finished in-place hardened shotcrete meeting the strength requirements of 780 CMR.

1914.3 Aggregate. Coarse aggregate, if used, shall not exceed ¾ inch (19.1 mm).

1914.4 Reinforcement. Reinforcement used in shotcrete construction shall comply with the provisions of 780 CMR 1914.4.1 through 1914.4.4.

1914.4.1 Size. The maximum size of reinforcement shall be No. 5 bars unless it is demonstrated by preconstruction tests that adequate encasement of larger bars will be achieved.

1914.4.2 Clearance. When No. 5 or smaller bars are used, there shall be a minimum clearance between parallel reinforcement bars of 2½ inches (64 mm). When bars larger than No. 5 are permitted, there shall be a minimum clearance between parallel bars equal to six diameters of the bars used. When two curtains of steel are provided, the curtain nearer the nozzle shall have a minimum spacing equal to 12 bar diameters and the remaining curtain shall have a minimum spacing of six bar diameters.

> **Exception**. Subject to the approval of the responsible registered design professional, required clearances may be reduced where it is demonstrated by preconstruction tests that adequate encasement of the bars used in the design will be achieved.

1914.4.3 Splices. Lap splices of reinforcing bars shall utilize the noncontact lap splice method with a minimum clearance of two inches (51 mm) between bars. The use of contact lap splices necessary for support of the reinforcing is permitted when approved by the building official, based on satisfactory preconstruction tests that show that adequate encasement of the bars will be achieved, and provided that the splice is oriented so that a plane through the center of the spliced bars is perpendicular to the surface of the shotcrete.

1914.4.4 Spirally Tied Columns. Shotcrete shall not be applied to spirally tied columns.

1914.5 Preconstruction Tests. When required by the responsible registered design professional, a test panel shall be shot, cured, cored or sawn, examined and tested prior to commencement of the project. The sample panel shall be representative of the project and simulate job conditions as closely as possible. The panel thickness and reinforcing shall reproduce the thickest and most congested area specified in the structural design. It shall be shot at the same angle, using the same nozzleman and with the same concrete mix design that will be used on the project. The equipment used in preconstruction testing shall be the same equipment used in the work requiring such testing, unless substitute equipment is approved by the responsible registered design professional.

1914.6 Rebound. Any rebound or accumulated loose aggregate shall be removed from the surfaces to be covered prior to placing the initial or any succeeding layers of shotcrete. Rebound shall not be used as aggregate.

1914.7 Joints. Except where permitted herein, unfinished work shall not be allowed to stand for more than 30 minutes unless edges are sloped to a thin edge. For structural elements that will be under compression and for construction joints shown on the approved construction documents, square joints are permitted. Before placing additional material adjacent to previously applied work, sloping and square edges shall be cleaned and wetted.

1914.8 Damage. In-place shotcrete that exhibits sags, sloughs, segregation, honeycombing, sand pockets or other obvious defects shall be removed and replaced. Shotcrete above sags and sloughs shall be removed and replaced while still plastic.

1914.9 Curing. During the curing periods specified herein, shotcrete shall be maintained above 40°F (4°C) and in moist condition.

1914.9.1 Initial Curing. Shotcrete shall be kept continuously moist for 24 hours after shotcreting is complete or shall be sealed with an approved curing compound.

1914.9.2 Final Curing. Final curing shall continue for seven days after shotcreting, or for three days if high- early-strength cement is used, or until the specified strength is obtained. Final curing shall consist of the initial curing process or the shotcrete shall be covered with a moisture-retaining cover approved by the responsible registered design professional.

1914.9.3 Natural Curing. Natural curing shall not be used in lieu of that specified in this section unless the relative humidity remains at or above 85%, and is authorized by the responsible registered design professional.

1914.10 Strength Tests. Strength tests for shotcrete shall be made by an approved agency on specimens that are representative of the work and which have been water soaked for at least 24 hours prior to testing. When the maximum size aggregate is larger than ⅜ inch (9.5 mm), specimens shall consist of not less than three-inch (76 mm) diameter cores or three-inch (76 mm) cubes. When the maximum size aggregate is ⅜ inch (9.5 mm) or smaller, specimens shall consist of not less than two-inch (51 mm) diameter cores or two-inch (51 mm) cubes.

1914.10.1 Sampling. Specimens shall be taken from the in-place work or from test panels, and shall be taken at least once each shift, but not less than one for each 50 cubic yards (38.2 m^3) of shotcrete.

1914.10.2 Panel Criteria. When the maximum size aggregate is larger than ⅜ inch (9.5 mm), the test panels shall have minimum dimensions of 18 inches by 18 inches (457 mm by 457 mm). When the maximum size aggregate is ⅜ inch (9.5 mm) or smaller, the test panels shall have minimum dimensions of 12 inches by 12 inches (305 mm by 305 mm). Panels shall be shot in the same position as the work, during the course of the work and by the nozzlemen doing the work. The conditions under which the panels are cured shall be the same as the work.

1914.10.3 Acceptance Criteria. The average compressive strength of three cores from the in-place work or a single test panel shall equal or exceed 0.85 f'_c with no single core less than 0.75 f'_c. The average compressive strength of three cubes taken from the in-place work or a single test panel shall equal or exceed f'_c with no individual panel shall equal or exceed f'_c with no individual cube less than 0.88 f'_c. To check accuracy, locations represented by erratic core or cube strengths shall be retested.

780 CMR 1915.0 REINFORCED GYPSUM CONCRETE

1915.1 General. Reinforced gypsum concrete shall comply with the requirements of ASTM C 317 and ASTM C 956.

1915.2 Minimum Thickness. The minimum thickness of reinforced gypsum concrete shall be two inches (51 mm) except the minimum required thickness may be reduced to 1½ inches (38 mm), provided the following conditions are satisfied:

1. The overall thickness, including the formboard, is not less than two inches (51 mm).
2. The clear span of the gypsum concrete between supports does not exceed 33 inches (838 mm).
3. Diaphragm action is not required.
4. The design live load does not exceed 40 psf (1915 Pa).

780 CMR 1916.0 CONCRETE-FILLED PIPE COLUMNS

1916.1 General. Concrete-filled pipe columns shall be manufactured from standard, extra-strong or double-extra-strong steel pipe or tubing that is filled with concrete so placed and manipulated as to secure maximum density and to ensure complete filling of the pipe without voids.

1916.2 Design. The safe supporting capacity of concrete-filled pipe columns shall be computed in accordance with ACI 318-02, Section 10.16.6 or AISC LRFD, Section 12 or determined by tests.

1916.3 Fire-resistance-rating Protection. Pipe columns shall be of such size or so protected as to develop the required fire-resistance ratings specified in Table 601. Where an outer steel shell is used to enclose the fire-resistive covering, the shell shall not be included in the calculations for strength of the column section. The minimum diameter of pipe columns shall be four inches (102 mm) except that in structures of Type V construction not exceeding three stories or 40 feet (12 192 mm) in height, pipe columns used in the basement and as secondary steel members shall have a minimum diameter of three inches (76 mm).

780 CMR 20.00

ALUMINUM

780 CMR 2001.0 GENERAL

2001.1 General. 780 CMR 20.00 shall govern he quality, design, fabrication and erection of aluminum.

780 CMR 2002.0 MATERIALS

2002.1 General Aluminum used for structural purposes in buildings and structures shall comply with AA ASM 35 and *the Aluminum Design Manual*, Parts 1-A and 1-B. The Nominal loads shall be the minimum design loads required by 780 CMR 16.00.

NON-TEXT PAGE

780 CMR 21.00

MASONRY

780 CMR 21.00 is unique to Massachusetts

780 CMR 2101.0 GENERAL

2101.1 General Masonry shall be designed and constructed in accordance with ACI 530/ASCE 5/TMS 402 (referred to as ACI 530) and ACI 530.1/ASCE 6/TMS 602 (referred to as ACI 530.1), except as provided otherwise in 780 CMR 21.00.

2101.2 Design. All masonry shall be designed as reinforced masonry using the allowable stress design method or the strength design method, except as follows:

1. Masonry veneer shall be designed in accordance with 780 CMR 1405.5 through 1405.9 and ACI 530, Chapter 6. Where there is a conflict between the provisions of ACI 530, Chapter 6 and 780 CMR 1405.6 through 1405.9, the more stringent requirements shall prevail.
2. Glass block masonry shall be designed in accordance with ACI 530, Chapter 7.
3. As specified otherwise in 780 CMR 2100.0.

2101.3 Lateral Load Resisting System. The lateral load resisting system shall include all masonry walls that are not structurally isolated from imposed in-plane loads other than from their own mass. All such walls shall be considered to be shear walls.

Exception. Elements not isolated from in-plane shear, such as narrow masonry walls and masonry wall piers between openings or between openings and the ends of the wall, which each have an in-plane stiffness less than 5% of the total stiffness of the lateral load resisting system in the same direction, may be omitted from the lateral load resisting system in that direction provided that the sum of the stiffnesses of the omitted elements is not greater than 10% of the total stiffness of the lateral load resisting system in that direction.

780 CMR 2102.0 DEFINITIONS AND NOTATIONS

2102.1 General. The following words and terms are not defined in ACI 530 or ACI 530.1; they shall, for the purposes of 780 CMR 2102.0 and as used elsewhere in 780 CMR, have the meanings shown in 780 CMR 2101.1.

ARCHITECTURAL TERRA COTTA. Plain or ornamental hard-burned modified clay units, larger in size than brick, with glazed or unglazed ceramic finish.

BOND BEAM. Same as *bond course*.

BOND COURSE. A horizontal grouted element within masonry in which reinforcement is embedded.

BRICK:

Calcium Silicate Brick (Sand Lime Brick). A masonry unit made of sand and lime.

Clay or Shale Brick. A masonry unit made of clay or shale, usually formed into a rectangular prism while in the plastic state and burned or fired in kiln.

Concrete Brick. A solid masonry unit having the approximate shape of a rectangular prism and composed of inert aggregate particles embedded in a hardened cementitious matrix.

Hollow Brick A masonry unit made of clay or shale whose net cross-sectional area is less than 75% of its gross cross-sectional area.

BUTTRESS. A projecting part of a masonry wall built integrally therewith to provide lateral stability.

CAST STONE. A building stone manufactured from portland cement concrete and used as a trim, veneer or facing on or in buildings or structures.

CELL. A void space having a gross cross-sectional area greater than 1½ square inches (967 mm^2).

CHIMNEY. A primarily vertical enclosure containing one or more passageways for conveying flue gases to the outside atmosphere.

CHIMNEY TYPES:

High-heat Appliance Type. An approved chimney for removing the products of combustion from fuel-burning, high-heat appliances producing combustion gases in excess of 2,000°F (1093°C) measured at the appliance flue outlet (see 780 CMR 2113.11.3).

Low-heat Appliance Type. An approved chimney for removing the products of combustion from fuel-burning, low-heat appliances producing combustion gases not in excess of 1,000°F (538°C) under normal operating conditions, but capable of producing combustion gases of 1,400°F (760°C) during intermittent forced firing for periods up to one hour. Temperatures shall be measured at the appliance flue outlet.

Masonry Type. A field-constructed chimney of solid masonry units or stones.

Medium-heat Appliance Type. An approved chimney for removing the products of combustion from fuel-burning, medium-heat appliances producing combustion gases not exceeding 2,000°F (1093°C) measured at the appliance flue outlet (see 780 CMR 2113.11.2).

CLEANOUT. An opening to the bottom of a grout space of sufficient size and spacing to allow the removal of debris.

COVER. Distance between surface of reinforcing bar and edge of member.

FACE SHELL. The outer portion of a hollow masonry unit as placed in masonry.

FIREPLACE. A hearth and fire chamber or similar prepared place in which a fire may be made and which is built in conjunction with a chimney.

FIREPLACE THROAT. The opening between the top of the firebox and the smoke chamber.

GROUTED MASONRY:

Grouted Hollow-unit Masonry. That form of grouted masonry construction in which certain designated cells of hollow units are continuously filled with grout.

Grouted Multi-wythe Masonry. That form of grouted masonry construction in which the space between the wythes is solidly or periodically filled with grout.

HEIGHT, WALLS. The vertical distance from the foundation wall or other intermediate support of such wall to the top of the wall, or where walls are divided into panels by relieving joints, the height of the panel. Where walls are infilled between framing members, the height is the height of the infilled panel.

LENGTH, WALLS. The distance from end to end of a wall, or when vertical control joints are present, the distance from an end to a control joint or the distance between control joints. Where walls are infilled between framing members, the length is the length of the infilled panel.

MASONRY. A built-up construction or combination of building units or materials of clay, shale, concrete, glass, gypsum, stone or other approved units bonded together with or without mortar or grout or other accepted method of joining.

Ashlar Masonry. Masonry composed of various sized, rectangular units having sawed, dressed or squared bed surfaces, properly bonded and laid in mortar.

Coursed Ashlar. Ashlar masonry laid in courses of stone of equal height for each course, although different courses shall be permitted to be of varying height.

Glass Unit Masonry. Nonload-bearing masonry composed of glass units bonded by mortar.

Plain Masonry. Masonry which is not reinforced.

Random Ashlar. Ashlar masonry laid in courses of stone set without continuous joints and laid up without drawn patterns. When composed of material cut into modular heights, discontinuous but aligned horizontal joints are discernible.

Reinforced Masonry. Masonry construction in which reinforcement acting in conjunction with the masonry is used to resist forces.

Solid Masonry. Masonry consisting of solid masonry units laid contiguously with the joints between the units filled with mortar.

MASONRY UNIT. Brick, tile, stone, glass block or concrete block.

Clay. A building unit larger in size than a brick, composed of burned clay, shale, fire clay or mixtures thereof.

Concrete. A building unit or block larger in size than 12 by four by four inches (305 mm by 102 mm by 102 mm) made of cement and suitable aggregates.

Hollow. A masonry unit whose net cross-sectional area in any plane parallel to the load-bearing surface is less than 75% of its gross cross-sectional area measured in the same plane.

Solid. A masonry unit whose net cross-sectional area in every plane parallel to the load-bearing surface is 75% or more of its gross cross-sectional area measured in the same plane.

MORTAR. A plastic mixture of approved cementitious materials, fine aggregates and water used to bond masonry or other structural units.

MORTAR, SURFACE-BONDING. A mixture to bond concrete masonry units that contain hydraulic cement, glass fiber reinforcement with or without inorganic fillers or organic modifiers, and water.

PRISM. An assemblage of masonry units and mortar with or without grout used as a test specimen for determining properties of the masonry.

RUBBLE MASONRY. Masonry composed of roughly shaped stones.

Coursed Rubble. Masonry composed of roughly shaped stones fitting approximately on level beds and well bonded.

Random Rubble. Masonry composed of roughly shaped stones laid without regularity of coursing but well bonded and fitted together to form well-divided joints.

Rough or Ordinary Rubble. Masonry composed of unsquared field stones laid without regularity of coursing but well bonded.

SPECIFIED. Required by construction documents.

STIRRUP. Shear reinforcement in a beam or flexural member.

STRENGTH:

Design Strength. Nominal strength multiplied by a strength reduction factor.

Nominal Strength. Strength of a member or cross section calculated in accordance with these provisions before application of any strength reduction factors.

Required Strength. Strength of a member or cross section required to resist factored loads.

TILE. A ceramic surface unit, usually relatively thin in relation to facial area, made from clay or a mixture of clay or other ceramic materials, called the body of the tile, having either a "glazed" or "unglazed" face and fired above red heat in the course of manufacture to a temperature sufficiently high enough to produce specific physical properties and characteristics.

TILE, STRUCTURAL CLAY. A hollow masonry unit composed of burned clay, shale, fire clay or mixture thereof, and having parallel cells.

WALL.

Composite Wall. A wall built of a combination of two or more masonry units bonded together, one forming the backup and the other forming the facing elements.

Dry-stacked, Surface-bonded Wall. A wall built of concrete masonry units where the units are stacked dry, without mortar on the bed or head joints, and where both sides of the wall are coated with a surface-bonding mortar.

Parapet Wall. The part of any wall entirely above the roof line.

WEB. An interior solid portion of a hollow-masonry unit as placed in masonry.

780 CMR 2103.0 MODIFICATIONS TO ACI 530

Underlined numbers refer to the sections or clauses of ACI 530.

1.6 At the end of the definition of *pier*, add "This definition does not apply to piers in masonry walls between openings and between openings and ends of walls.

1.11 Replace this section with the requirements for stack bond masonry in 780 CMR 2106.0.

1.12.2 Substitute Clause 3.2.3.1 for Clauses 1.12.2.1 and 1.12.2.2 (limitations to size of reinforcing steel bars).

2.1.3.3.1 Substitute 780 CMR 16.00" for "ASCE 7-98."

2.3.5 Substitute: "Members that are not subject to flexural tension shall be designed in accordance with the following:"

780 CMR 2104.0 MASONRY CONSTRUCTION MATERIALS

The requirements of 780 CMR 2104.0 are not covered in ACI 530 nor in ACI 530.1

2104.1 Clay or Shale Masonry Units for Fireproofing. Structural clay tile for nonstructural use in fireproofing of structural members and in wall furring shall not be required to meet the compressive strength requirements of the specifications cited in ACI 530.1, Clause 2.3B. The fire-resistance rating shall be determined in accordance with ASTM E 119 and shall comply with the requirements of Table 602.

2104.2 Ceramic Tile. Ceramic tile shall be as defined in ANSI A137.1 and shall conform to the requirements of ANSI A137.1.

2104.3 Second-hand Units. Second-hand masonry units shall not be reused unless the units conform to the requirements of new units. The units shall be of whole, sound materials and be free from cracks and other defects that will interfere with proper laying or use. Old mortar shall be cleaned from the unit before reuse.

2104.4 Surface-bonding Mortar. Surface-bonding mortar shall comply with ASTM C 887. Surface bonding of concrete masonry units shall comply with ASTM C 946.

2104.5 Mortars for Ceramic Wall and Floor Tile. Portland cement mortars for installing ceramic wall and floor tile shall comply with ANSI A108.1A and A108.1B and be of the compositions indicated in Table 2104-1.

TABLE 2104-1 CERAMIC TILE MORTAR COMPOSITIONS

LOCATION	MORTAR	COMPOSITION
Walls	Scratchcoat	one cement; $^1/_5$ hydrated lime; four dry or five damp sand
	Setting bed and leveling coat	one cement; ½ hydrated lime; five damp sand to one cement one hydrated lime, seven damp sand
Floors	Setting bed	one cement; $^1/_{10}$ hydrated lime; five dry or six damp sand; or one cement; fie dry or six damp sand
Ceilings	Scratchcoat and sand bed	one cement; ½ hydrated lime; 2½ dry sand or three damp sand

2104.5.1 Dry-set Portland Cement Mortars. Premixed prepared portland cement mortars, which require only the addition of water and which are used in the installation of ceramic tile, shall comply with ANSI A118.1. The shear bond strength for tile set in such mortar shall be as required in accordance with ANSI A118.1. Tile set in dry-set portland cement mortar shall be installed in accordance with ANSI A108.5.

2104.5.2 Electrically Conductive Dry-set Mortars. Premixed prepared portland cement mortars, which require only the addition of water and which comply with ANSI A118.2, shall be used in the installation of electrically conductive ceramic tile. Tile set in electrically conductive dry-set mortar shall be installed in accordance with ANSI A108.7.

2104.5.3 Latex-modified Portland Cement Mortar. Latex-modified portland cement thin-set mortars in which latex is added to dry-set mortar as a replacement for all or part of the gauging water that are used for the installation of ceramic tile shall comply with ANSI A118.4. Tile set in latex-modified portland cement shall be installed in accordance with ANSI A108.5.

2104.5.4 Epoxy Mortar. Ceramic tile set and grouted with chemical-resistant epoxy shall comply with ANSI A118.3. Tile set and grouted with epoxy shall be installed in accordance with ANSI A108.6.

2104.5.5 Furan Mortar and Grout. Chemical-resistant furan mortar and grout that are used to install ceramic tile shall comply with ANSI A118.5. Tile set and grouted with furan shall be installed in accordance with ANSI A108.8.

2104.5.6 Modified Epoxy-emulsion Mortar and Grout. Modified epoxy-emulsion mortar and grout that are used to install ceramic tile shall comply with ANSI A118.8. Tile set and grouted with modified epoxy-emulsion mortar and grout shall be installed in accordance with ANSI A108.9.

2104.5.7 Organic Adhesives. Water-resistant organic adhesives used for the installation of ceramic tile shall comply with ANSI A136.1. The shear bond strength after water immersion shall not be less than 40 psi (275 kPa) for Type I adhesive, and not less than 20 psi (138 kPa) for Type II adhesive, when tested in accordance with ANSI A136.1. Tile set in organic adhesives shall be installed in accordance with ANSI A108.4.

2104.5.8 Portland Cement Grouts. Portland cement grouts used for the installation of ceramic tile shall comply with ANSI A118.6. Portland cement grouts for tile work shall be installed in accordance with ANSI A108.10.

780 CMR 2105.0 CONSTRUCTION

Requirements in 780 CMR 2105.0 are in addition to those of ACI 530 and ACI 530.1.

2105.1 Open-end Units. Open-end units with beveled ends shall be fully grouted. Head joints of open-end units with beveled ends need not be mortared. The beveled ends shall form a grout key that permits grouts within ⅝ inch (15.9 mm) of the face of the unit. The units shall be tightly butted to prevent leakage of the grout.

2105.2 Chases and Recesses. Chases and recesses shall be constructed as masonry units are laid. Masonry directly above chases or recesses wider than 12 inches (305 mm) shall be supported on lintels.

2105.3 Lintels. Minimum length of end support shall be four inches (102 mm).

2105.4 Support on Wood. Masonry shall not be supported on wood girders or other forms of wood construction except as permitted in 780 CMR 2304.7.

2105.5 Weep Holes. Weep holes provided in the outside wythe of masonry walls shall be at a maximum spacing of 33 inches (838 mm) on center. Weep holes shall not be less than $^{3}/_{16}$ inch (4.8 mm) in diameter.

2105.6 Corbelled Masonry. The maximum corbelled projection beyond the face of the wall shall not be more than one-half of the wall thickness nor one-half the wythe thickness for hollow walls. The maximum projection of one unit shall neither exceed one-half the height of the unit nor one-third the thickness at right angles to the wall.

2105.6.1 Molded Cornices. Unless structural support and anchorage are provided to resist the overturning moment, the center of gravity of projecting masonry or molded cornices shall lie within the middle ⅓ of the supporting wall. Terra cotta and metal cornices shall be provided with a structural frame of approved noncombustible material anchored in an approved manner.

780 CMR 2106.0 SEISMIC DESIGN FOR SHEAR WALLS

2106.1 Seismic Requirements for Masonry Shear Walls. Replace the requirements for masonry shear walls of ACI 530, Section 1.13 with the requirements of 780 CMR 2106.0.

2106.1.1 Design of Shear Walls. Design of shear walls for the forces specified in 780 CMR 16 shall be in accordance with the strength design method. The design shall comply with the requirements of ACI 530, Sections 3.1 and 3.2, and for prestressed shear walls with the additional requirements of ACI 530, Chapter 4.

2106.1.2 Seismic Design Categories B and C. Masonry shear walls for Seismic Design Categories B and C shall be intermediate reinforced masonry shear walls or special reinforced masonry shear walls.

2106.1.3 Seismic Design Category D. Masonry shear walls for Seismic Design Category D shall be special reinforced masonry shear walls.

2106.2 Minimum Masonry Wall Thickness. Shear walls shall have a minimum nominal thickness of six inches.

2106.3 Restrictions on Mortar. Masonry cement is not permitted for shear walls. Mortar shall be Type M or S.

2106.4 Stack Bond. For shear walls laid in stack bond, the head joints shall be solidly filled and cells shall be fully grouted.

2106.5 Connections of Shear Walls to Roof and Floor Diaphragms.

2106.5.1 In-plane Shear Transfer. The connections between a shear wall and a floor or roof shall be capable of transferring the design in-plane shear force, but not less than 280 lbs/ft of wall for strength design or 190 lbs/ft of wall for allowable stress design.

2106.5.2 Out-of-plane Connection. The connections between a wall and a floor or roof shall be capable of resisting the out-of-plane design forces in accordance with 780 CMR 1615.0.

2106.6 Piers Between Openings in Shear Walls. The minimum length of pier between openings in shear walls or at the side of an opening at the end of a shear wall shall be 24 inches.

2106.7 Reinforcement Requirements.

2106.7.1 General. Except as provided otherwise in 780 CMR 2106.10, reinforcement shall be steel reinforcing bars in grouted vertical cells or grouted horizontal bond courses of hollow unit masonry, or in grouted collar joints between two masonry wythes.

2106.7.2 Vertical Reinforcement. Provide vertical reinforcement of at least 0.2 in.^{2} at wall corners, within 8 in. of each side of expansion and control joints, within eight in. of the ends of walls, and within 16 in. of each side of openings that are larger than 16 in. in either the horizontal or vertical direction. For openings that interrupt distributed reinforcement, provide reinforcement on each side of the opening regardless of its size. The vertical reinforcement at corners, at ends of walls, and to each side of expansion and control joints shall be continuous from bottom to top of the wall. Vertical reinforcement to each side of openings shall extend from the bond course at the bottom of wall or floor framing below the opening to the bond course at the floor framing above the opening, but not less than the reinforcement development length above and below the opening unless at the bottom or top of the wall. For openings that align vertically, reinforcement to each side of the openings shall be spliced or otherwise constructed continuous between levels.

2106.7.3 Horizontal Reinforcement. Provide continuous horizontal reinforcement of at least 0.2 in.^{2} in a bond course at the bottom of a wall, at floor and roof levels connected to the wall, and within 16 in. of the top of the wall. Provide horizontal reinforcement of at least 0.2 in.^{2} at the top and bottom of openings larger than 16 in. in either the horizontal or vertical direction. Extend reinforcement a development length but not less than 24 in. beyond the edges of openings.

2106.7.4 Piers Between Openings in Shear Walls. The spacing of horizontal reinforcing bars in piers between openings in a shear wall or in piers between an opening and the end of a shear wall, that are part of the lateral load resisting system, shall not be more than ⅓ the height of the pier, ⅓ the length of the pier, or the spacing required for the wall a a whole, whichever is less.

2106.8 Special Reinforced Masonry Shear Walls.

2106.8.1 Reinforcement Requirements. In addition to the reinforcement required by 780 CMR 2106.7, provide minimum distributed reinforcement as required by 780 CMR 2106.8.1.1 and 2106.8.1.2.

2106.8.1.1 Minimum Cross-sectional Area of Distributed Reinforcement.

1. The minimum total cross-sectional area provided by the reinforcing bars in the vertical and horizontal directions shall be 0.002 times the gross cross-sectional area of the wall.
2. The minimum cross-sectional area of horizontal reinforcing bars for running bond shall be 0.0007 times the gross cross-sectional area of the wall.
3. The minimum cross-sectional area of horizontal reinforcing bars for stack bond shall be 0.0015 times the gross cross-sectional area of the wall.
4. The minimum cross-sectional area of vertical reinforcing bars shall be 0.0007 times the gross cross-sectional area of the wall, but shall not be less than ⅓ of the cross-sectional area of horizontal reinforcement that is required for running bond.

2106.8.1.2. Maximum Spacing for Distributed Vertical Reinforcement. The maximum spacing of distributed vertical reinforcing bars shall be ⅓ the length of the wall, ⅓ the height of the wall, or four feet-zero inches, whichever is less.

2106.8.1.3 Maximum Spacing for Distributed Horizontal Reinforcement. The maximum spacing of horizontal reinforcing bars for running bond shall be ⅓ the length of the wall, ⅓ the height of the wall, or four feet-zero inches, whichever is less. The maximum spacing of horizontal reinforcing bars for stack bond shall be ⅓ the length of the wall, ⅓ the height of the wall, or two feet-zero inches, whichever is less.

2106.8.1.4 Anchorage of Reinforcement. All horizontal reinforcing bars in shear walls shall be anchored around the vertical reinforcement at the ends of the walls or at the jambs of openings with a standard 180° hook, except that a 90° hook shall be used at wall intersections. All vertical reinforcement terminating above or below an opening shall be anchored around a horizontal reinforcing bar with a standard 180° hook

2106.9 Intermediate Reinforced Masonry Shear Walls.

2106.9.1 Reinforcement Requirements. In addition to the reinforcement required by 780 CMR 2106.7, provide minimum distributed reinforcement as required by 780 CMR 2106.9.1.1 and 2106.9.1.2.

2106.9.1.1 Minimum Cross-sectional Area of Distributed Reinforcement.

1. The minimum total cross-sectional area provided by the reinforcing bars in the

vertical and horizontal directions shall be 0.002 times the gross cross-sectional area of the wall.

2. The minimum cross-sectional area of horizontal reinforcing bars for running bond shall be 0.0007 times the gross cross-sectional area of the wall.

3. The minimum cross-sectional area of horizontal reinforcing bars for stack bond shall be 0.0015 times the gross cross-sectional area of the wall.

4. The minimum cross-sectional area of vertical reinforcing bars shall be 0.0007 times the gross cross-sectional area of the wall, but shall not be less than one-third of the cross-sectional area of horizontal reinforcement that is required for running bond.

2106.9.1.2.Maximum Spacing for Distributed Vertical Reinforcement. The maximum spacing of distributed vertical reinforcing bars shall be ⅓ the length of the wall, ⅓ the height of the wall, or four feet-zero inches, whichever is less.

2106.9.1.3 Maximum Spacing for Distributed Horizontal Reinforcement. The maximum spacing of horizontal reinforcing bars for running bond shall be shall be ⅓ the length of the wall, ⅓ the height of the wall, or four feet-zero inches, whichever is less. The maximum spacing of horizontal reinforcing bars for stack bond shall be ⅓ the length of the wall, ⅓ the height of the wall, or two feet-zero inches, whichever is less.

2106.10 Prestressed Masonry Shear Walls.

2106.10.1 Reinforcement. Provide minimum distributed reinforcement as required by 780 CMR 2106.9. The cross-sectional area of bonded prestressing tendons shall be considered to contribute to the minimum reinforcement requirements.

2106.10.2 Shear Design. The design for in-plane shear shall rely on bonded reinforcement and shall be in accordance with ACI 530, Section 3.2.

2106.11 Elements Excluded from Lateral Load Resisting System. Elements not isolated from in-plane shear which are not considered to be part of the lateral load resisting system in accordance with the exception in 780 CMR 2101.3 shall be designed with sufficient strength and ductility to maintain vertical load carrying capacity when displaced to the design story drift The minimum reinforcing for walls or wall segments shall be in accordance with that required for Class A walls in 780 CMR 2107.4.1 .

780 CMR 2107.0 WALLS ISOLATED FROM THE LATERAL LOAD RESISTING SYSTEM

Replace the requirements of ACI 530, Section 1.13 for masonry walls that are isolated from the lateral load resting system with the requirements of 780 CMR 2107.0.

2107.1 Glass Block Unit Masonry. Glass unit masonry walls shall be designed in accordance with ACI 530, Chapter 7. Glass Masonry walls shall be structurally isolated from imposed in-plane forces other than that due to their own mass. Glass masonry walls shall have horizontal and vertical reinforcement located not more than 48 inches on center, located in mortar joints, and extending the entire length and width of the panel but not across expansion joints.

The minimal cross-sectional area of the horizontal reinforcing bars shall be 0.0015 times the gross cross-sectional area of the wall.

The minimal cross-sectional area of the vertical reinforcing shall be 0.0007 times the gross cross-sectional area of the wall.

2107.2 Isolation from In-plane Force. Walls that are isolated from the lateral load resisting system shall have connections to the structure that do not transfer in-plane forces from the structure to the walls. These connections shall be designed to accommodate the design story drift and provide lateral support.

2107.3 Classification of Walls Isolated from the Lateral Load Resisting System. Walls that are isolated from the lateral load resisting system shall be classified as follows:

Class A: Exterior walls, walls enclosing exits, and walls enclosing elevator shafts.

Class B: Walls not classified as Class A and which are more than 16 feet in height.

Class C: Walls not classified as Class A and which are 16 feet in height or less.

2107.4 Design of Walls Isolated from the Lateral Force Resisting System. Design walls that are isolated from the lateral force resisting system to resist applicable out-of-plane forces defined in 780 CMR 16.00. The design shall meet the Allowable Stress Design provisions in ACI 530, Chapter 2 or the Strength Design provisions in ACI 530, Chapter 3. The reinforcement shall not be less than required by 780 CMR 2107.4.1, 2107.4.2, or 2107.4.3 for the applicable class of wall. Anchorage of a wall to a structure shall be consistent with the direction that the wall is designed to span.

2107.4.1 Class a Wall Minimum Reinforcement.

2107.4.1.1 In direction of Span. The minimum reinforcement in the direction of the span shall be bed joint reinforcement or reinforcing steel bars in grouted cells, grouted bond courses, or grouted collar joints. The minimum cross-sectional area of the reinforcement shall be 0.0007 times the gross cross-sectional area of the wall. The maximum spacing of reinforcing bars shall be the lesser of ⅓ of the span or four feet-zero inches.

2107.4.1.2 Perpendicular to Span. The minimum quantity of reinforcement perpendicular to the span shall be No. 5 bars in grouted cells, grouted bond courses, or grouted collar joints spaced at the lesser of ⅓ of the span or six feet-zero inches o.c., or, alternatively in the case of vertically spanning walls, horizontal joint reinforcement consisting of a minimum of 2 – W1.7 wires at a maximum spacing of 16 inches o.c.

2107.4.1.3 Additional Reinforcement. Additional reinforcement shall be bars in grouted cells, grouted bond courses, or grouted collar joints. Horizontal bars shall be provided at the bottom or top of wall openings, extending 24 inches or 40 bar diameters, whichever is more, past the opening; and continuously at structurally connected floor and roof levels. Vertical bars shall be provided at corners, within 16 inches of the sides of openings, within eight inches of each side of movement joints, and within eight inches of the ends of walls.

2107.4.2 Class B Wall Minimum Reinforcement.

2107.4.2.1 Vertical Reinforcement. Vertical reinforcement of at least 0.2 square inches in cross-sectional area shall be provided at corners, within 16 inches of each side of openings, within eight inches of each side of movement joints, within eoght inches of the ends of walls, and at a maximum spacing of 48 inches.

2107.4.2.2 Horizontal Reinforcement. Horizontal reinforcement shall consist of at least 2- W1.7 wires spaced not more than 16 inches o.c. Horizontal reinforcement of at least 0.2 square inches in cross-sectional area shall also be provided at the bottom and top of wall openings and shall extend not less than 24 inches nor less than 40 bar diameters past the opening; continuously at structurally connected roof and floor levels; within 16 inches of the top of walls; and at a maximum spacing of 48 inches.

2107.4.3 Class C wall minimum reinforcement. Walls shall be reinforced in the vertical direction when the walls span vertically and in the horizontal direction when the walls span horizontally, in accordance with the following:

2107.4.3.1 In the Horizontal Direction. Horizontal reinforcement shall consist of at least two longitudinal W1.7 wires spaced not more than 16 in. (vertical) for walls greater than four inches in width and at least one longitudinal W1.7 wire spaced not more than 16 inches for walls not exceeding four inches in width; or at least one No. 4 bar spaced not more than 48 inches. Where two longitudinal wires of joint reinforcement are used, the space between these wires shall be the widest that the mortar joint will accommodate. Horizontal reinforcement shall be provided within 16 inches of the top and bottom of these masonry elements.

2107.4.3.2 In the Vertical Direction. No. 4 bars spaced not more than 48 inches o.c. and within 16 inches from the ends of walls, in grouted cells or collar joints.

780 CMR 2108.0 ADDITIONAL REQUIREMENTS

2108.1 Connections to Masonry Columns. Connectors shall be provided to transfer forces between masonry columns and horizontal elements. Where anchor bolts are used to connect horizontal elements to the tops of columns, anchor bolts shall be placed within lateral ties. Lateral ties shall enclose both the vertical bars in the column and the anchor bolts. There shall be a minimum of two No. 4 lateral ties provided in the top five inches (127 mm) of the column.

2108.2 Column Displacement. Columns shall have sufficient ductility to maintain vertical load carrying capacity when displaced to the design story drift.

2108.3 Discontinuous Members. Columns and pilasters supporting reactions from discontinuous stiff members such as walls shall be provided with transverse reinforcement spaced at no more than one-fourth of the least nominal dimension of the column or pilaster. The minimum transverse reinforcement ratio shall be 0.0015. Beams supporting reactions from discontinuous walls or frames shall be provided with transverse reinforcement spaced at no more than ½ of the nominal depth of the beam. The minimum transverse reinforcement ratio shall be 0.0015.

2108.4 Parapet Walls. Parapet walls shall be at least eight inches thick and the height shall not be greater than three times its thickness. Parapet walls shall be reinforced the same as masonry shear walls.

780 CMR 2109.0 AND 2110.0: RESERVED

780 CMR 2111.0 MASONRY FIREPLACES

2111.1 Definition. A masonry fireplace is a fireplace constructed of concrete or masonry. Masonry fireplaces shall be constructed in accordance with 780 CMR 2109.0, Table 2111.1 and Figure 2111.1.

2111.1.1 Fireplace Drawings. The construction documents shall describe in sufficient detail the location, size and construction of masonry fireplaces. The thickness and characteristics of materials and the clearances from walls, partitions and ceilings shall be clearly indicated.

2111.2 Footings and Foundations. Foundations for masonry fireplaces and their chimneys shall be constructed of concrete or solid masonry at least 12 inches (305 mm) thick, and shall extend at least six inches (152 mm) beyond the face of the fireplace or foundation wall on all sides. Footings shall be founded on natural undisturbed earth or engineered fill below frost depth.

2111.2.1 Ash Dump Cleanout. Cleanout openings located within foundation walls below fireboxes, when provided, shall be equipped with ferrous metal or masonry doors and frames constructed to remain tightly closed, except when in use. Cleanouts shall be accessible and located so that ash removal will not create a hazard to combustible materials.

2111.3 Seismic Reinforcing. Masonry or concrete fireplaces shall be constructed, anchored, supported and reinforced as required in 780 CMR 21.00. Masonry and concrete fireplaces shall be reinforced and anchored as detailed in 780 CMR 2111.3.1, 2111.3.2, 2111.4 and 2111.4.1 for chimneys serving fireplaces.

2111.3.1 Vertical Reinforcing. For fireplaces with chimneys up to 40 inches (1016 mm) wide, four No. 4 continuous vertical bars, anchored in the foundation, shall be placed in the concrete, between wythes of solid masonry or within the cells of hollow unit masonry and grouted. For fireplaces with chimneys greater than 40 inches (1016 mm) wide, two additional No. 4 vertical bars shall be provided for each additional 40 inches (1016 mm) in width or fraction thereof.

2111.3.2 Horizontal Reinforcing. Vertical reinforcement shall be placed enclosed within ¼-inch (6.4 mm) ties or other reinforcing of equivalent net cross-sectional area, spaced not to exceed 18 inches (457 mm) on center in concrete; or placed in the bed joints of unit masonry at a minimum of every 18 inches (457 mm) of vertical height. Two such ties shall be provided at each bend in the vertical bars.

2111.4 Seismic Anchorage. Masonry and concrete chimneys shall be anchored at each floor, ceiling or roof line more than six feet (1829 mm) above grade, except where constructed completely within the exterior walls. Anchorage shall conform to the following requirements.

2111.4.1 Anchorage. Two $^3/_{16}$-inch by one-inch (4.8 mm by 25.4 mm) straps shall be embedded a minimum of 12 inches (305 mm) into the chimney. Straps shall be hooked around the outer bars and extend six inches (152 mm) beyond the bend. Each strap shall be fastened to a minimum of four floor joists with two ½-inch (12.7 mm) bolts.

TABLE 2111.1 SUMMARY OF REQUIREMENTS FOR MASONRY FIREPLACES AND CHIMNEYS[a]

ITEM	LETTER	REQUIREMENTS	SECTION
Hearth and hearth extension thickness	A	4-inch minimum thickness for hearth, 2-inch minimum thickness for hearth extension.	2111.9
Hearth extension (each side of opening)	B	8 inches for fireplace opening less than 6 square feet. 12 inches for fireplace opening greater than or equal to 6 square feet.	2111.1
Hearth extension (front of opening)	C	16 inches for fireplace opening less than 6 square feet. 20 inches for fireplace opening greater than or equal to 6 square feet.	2111.1
Firebox dimensions	—	20-inch minimum firebox depth. 12-inch minimum firebox depth for Rumford fireplaces.	2111.6
Hearth and hearth extension reinforcing	D	Reinforced to carry its own weight and all imposed loads.	2111.9
Thickness of wall of firebox	E	10 inches solid masonry or 8 inches where firebrick lining is used.	2111.5
Distance from top of opening to throat	F	8 inches minimum.	2111.1 111.7.1
Smoke chamber wall thickness dimensions	G	6 inches lined; 8 inches unlined. Not taller than opening width; walls not inclined more than 45 degrees from vertical for prefabricated smoke chamber linings or 30 degrees from vertical for corbeled masonry.	2111.8
Chimney vertical reinforcing	H	Four No. 4 full-length bars for chimney up to 40 inches wide. Add two No. 4 bars for each additional 40 inches or fraction of width, or for each additional flue.	2111 3.1, 2113.3.1
Chimney horizontal reinforcing	J	¼-inch ties at each 18 inches, and two ties at each bend in vertical steel.	2111.3.2, 2113.3.2
Fireplace lintel	L	Noncombustible material with 4-inch bearing length of each side of opening.	2111.7
Chimney walls with flue lining	M	4-inch-thick solid masonry with ⅝-inch fireclay liner or equivalent. ½-inch grout or airspace between fireclay liner and wall.	2113.11.1
Effective flue area (based on area of fireplace opening and chimney)	P	See 780 CMR 2113.16.	2113.16
Clearances From chimney From fireplace From combustible trim or materials Above roof	R	2 inches interior, 1 inch exterior or 12 inches from lining. 2 inches back or sides or 12 inches from lining. 6 inches from opening 3 feet above roof penetration, 2 feet above part of structure within 10 feet.	2113.19 2111.11 2111.12 2113.9
Anchorage strap Number required Embedment into chimney Fasten to Number of bolts	S	3/16 inch by 1 inch Two 12 inches hooked around outer bar with 6-inch extension. 4 joists Two ½-inch diameter.	2111.4 2113.4.1
Footing Thickness Width	T	12-inch minimum. 6 inches each side of fireplace wall.	2111.2

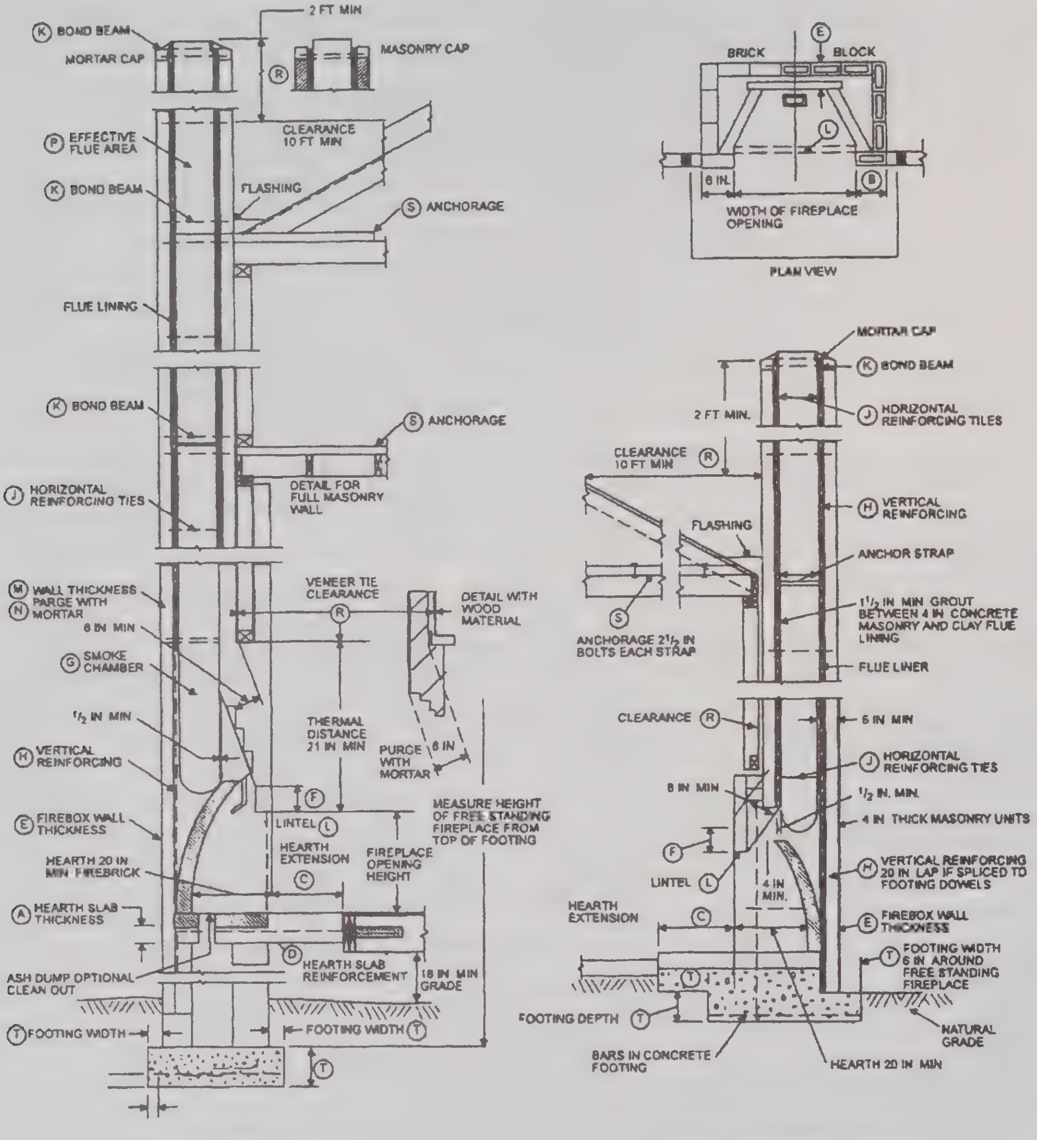
For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 square foot = 0.0929 m^2

a. Table 2111.1 provides a summary of major requirements for the construction of masonry chimneys and fireplaces. Letter references are to Figure 2111.1, which shows examples of typical construction. Table 21111.1 does not cover all requirements, nor does it cover all aspects of the indicated requirements. For the actual mandatory requirements of780 CMR, see the indicated section of text.

2111.5 Firebox Walls. Masonry fireboxes shall be constructed of solid masonry units, hollow masonry units grouted solid, stone, or concrete. When a lining of firebrick at least two inches (51 mm) in thickness or other approved lining is provided, the minimum thickness of back and side walls shall be eight inches (203 mm) of solid masonry, including the lining. The width of joints between firebricks shall not be greater than ¼ inch (6.4 mm). When no lining is provided, the total minimum thickness of back and side walls shall be ten inches (254 mm) of solid masonry. Firebrick shall conform to ASTM C 27 or ASTM C 1261 and shall be laid with medium-duty refractory mortar conforming to ASTM C 199.

2111.5.1 Steel Fireplace Units. Steel fireplace units are permitted to be installed with solid masonry to form a masonry fireplace when installed according to either the requirements of their listing or the requirements of this section. Steel fireplace units incorporating a steel firebox liner shall be constructed with steel not less than ¼ inch (6.4 mm) in thickness, and an air-circulating which is ducted to the interior of the building. The firebox lining shall be encased with solid masonry to provide a total thickness at the back and sides of not less than eight inches (203 mm), of which not less than four inches (102 mm) shall be of solid masonry or concrete. Circulating air ducts employed with steel fireplace units shall be constructed of metal or masonry.

FIGURE 2111.1 FIREPLACE AND CHIMNEY DETAILS


2 FT MIN
Ⓚ BOND BEAM
MORTAR CAP
MASONRY CAP
Ⓡ
CLEARANCE 10 FT MIN
Ⓟ EFFECTIVE FLUE AREA
Ⓚ BOND BEAM
FLASHING
Ⓢ ANCHORAGE
FLUE LINING
Ⓚ BOND BEAM
Ⓢ ANCHORAGE
DETAIL FOR FULL MASONRY WALL
Ⓙ HORIZONTAL REINFORCING TIES
Ⓜ WALL THICKNESS
Ⓝ PARGE WITH MORTAR
VENEER TIE CLEARANCE
Ⓡ
DETAIL WITH WOOD MATERIAL
8 IN MIN
Ⓖ SMOKE CHAMBER
½ IN MIN
THERMAL DISTANCE 21 IN MIN
PURGE WITH MORTAR
6 IN
Ⓗ VERTICAL REINFORCING
Ⓕ
MEASURE HEIGHT OF FREE STANDING FIREPLACE FROM TOP OF FOOTING
Ⓔ FIREBOX WALL THICKNESS
LINTEL Ⓛ
HEARTH EXTENSION Ⓒ
FIREPLACE OPENING HEIGHT
HEARTH 20 IN MIN FIREBRICK
Ⓐ HEARTH SLAB THICKNESS
Ⓓ
HEARTH SLAB REINFORCEMENT
18 IN MIN GRADE
ASH DUMP OPTIONAL CLEAN OUT
Ⓣ FOOTING WIDTH
FOOTING WIDTH Ⓣ
Ⓣ
Ⓔ
BRICK
BLOCK
Ⓛ
6 IN.
Ⓑ
WIDTH OF FIREPLACE OPENING
PLAN VIEW
MORTAR CAP
Ⓚ BOND BEAM
2 FT MIN.
Ⓙ HORIZONTAL REINFORCING TILES
CLEARANCE 10 FT MIN Ⓡ
Ⓗ VERTICAL REINFORCING
FLASHING
ANCHOR STRAP
Ⓢ
ANCHORAGE 2½ IN BOLTS EACH STRAP
1½ IN MIN GROUT BETWEEN 4 IN CONCRETE MASONRY AND CLAY FLUE LINING
FLUE LINER
CLEARANCE Ⓡ
6 IN MIN
Ⓙ HORIZONTAL REINFORCING TIES
8 IN MIN
½ IN. MIN.
4 IN THICK MASONRY UNITS
Ⓕ
LINTEL Ⓛ
4 IN MIN.
Ⓜ VERTICAL REINFORCING 20 IN. LAP IF SPLICED TO FOOTING DOWELS
HEARTH EXTENSION
Ⓒ
Ⓔ FIREBOX WALL THICKNESS
Ⓣ FOOTING WIDTH 6 IN AROUND FREE STANDING FIREPLACE
FOOTING DEPTH Ⓣ
NATURAL GRADE
BARS IN CONCRETE FOOTING
HEARTH 20 IN MIN

BRICK FIREBOX AND CHIMNEY— SECTIONAL SIDE VIEW ON WOOD FLOOR

BRICK FIREBOX AND BLOCK CHIMNEY— SECTIONAL SIDE VIEW ON CONCRETE SLAB

Fir SI: 1 inch = 25.4 mm. 1 foot = 304.8 mm.

2111.6 Firebox Dimensions. The firebox of a concrete or masonry fireplace shall have a minimum depth of 20 inches (508 mm). The throat shall not be less than eight inches (203 mm) above the fireplace opening. The throat opening shall not be less than four inches (102 mm) in depth. The cross-sectional area of the passageway above the firebox, including the throat, damper and smoke chamber, shall not be less than the cross-sectional area of the flue.

> **Exception**: Rumford fireplaces shall be permitted provided that the depth of the fireplace is at least 12 inches (305 mm) and at least ⅓ of the width of the fireplace opening, and the throat is at least 12 inches (305 mm) above the lintel, and at least 1/20 the cross-sectional area of the fireplace opening.

2111.7 Lintel and throat. Masonry over a fireplace opening shall be supported by a lintel of noncombustible material. The minimum required bearing length on each end of the fireplace opening shall be four inches (102 mm). The fireplace throat or damper shall be located a minimum of eight inches (203 mm) above the top of the fireplace opening.

2111.7.1 Damper. Masonry fireplaces shall be equipped with a ferrous metal damper located at least eight inches (203 mm) above the top of the fireplace opening. Dampers shall be installed in the fireplace or at the top of the flue venting the fireplace, and shall be operable from the room containing the fireplace. Damper controls shall be permitted to be located in the fireplace.

2111.8 Smoke Chamber Walls. Smoke chamber walls shall be constructed of solid masonry units, hollow masonry units grouted solid, stone or concrete. Corbelling of masonry units shall not leave unit cores exposed to the inside of the smoke chamber. The inside surface of corbelled masonry shall be parged smooth. Where no lining is provided, the total minimum thickness of front, back and sidewalls shall be eight inches (203 mm) of solid masonry. When a lining of firebrick at least two inches (51 mm) thick, or a lining of vitrified clay at least ⅝ inch (15.9 mm) thick, is provided, the total minimum thickness of front, back and sidewalls shall be six inches (152 mm) of solid masonry, including the lining. Firebrick shall conform to ASTM C 27 or ASTM C 1261 and shall be laid with refractory mortar conforming to ASTM C 199.

2111.8.1 Smoke Chamber Dimensions. The inside height of the smoke chamber from the fireplace throat to the beginning of the flue shall not be greater than the inside width of the fireplace opening. The inside surface of the smoke chamber shall not be inclined more than 45 degrees from vertical when prefabricated smoke chamber linings are used or when the smoke chamber walls are rolled or sloped rather than corbelled. When the inside surface of the smoke chamber is formed by corbelled masonry, the walls shall not be corbelled more than 30 degrees from vertical.

2111.9 Hearth and Hearth Extension. Masonry fireplace hearths and hearth extensions shall be constructed of concrete or masonry, supported by noncombustible materials, and reinforced to carry their own weight and all imposed loads. No combustible material shall remain against the underside of hearths or hearth extensions after construction.

2111.9.1 Hearth Thickness. The minimum thickness of fireplace hearths shall be four inches (102 mm).

2111.9.2 Hearth Extension Thickness. The minimum thickness of hearth extensions shall be two inches (51 mm).

Exception. When the bottom of the firebox opening is raised at least eight inches (203 mm) above the top of the hearth extension, a hearth extension of not less than ⅜-inch-thick (9.5 mm) brick, concrete, stone, tile or other approved noncombustible material is permitted.

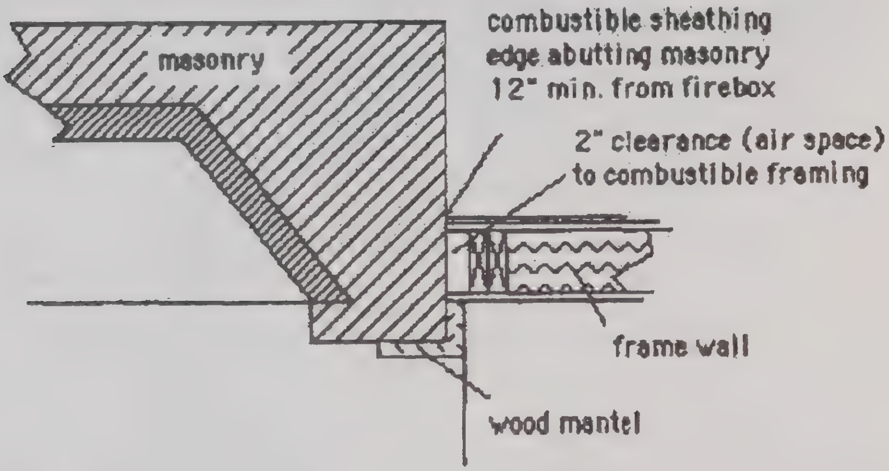
2111.10 Hearth Extension Dimensions. Hearth extensions shall extend at least 16 inches (406 mm) in front of, and at least eight inches (203 mm) beyond, each side of the fireplace opening. Where the fireplace opening is six square feet (0.557 M^2) or larger, the hearth extension shall extend at least 20 inches (508 mm) in front of, and at least 12 inches (305 mm) beyond, each side of the fireplace opening.

2111.11 Fireplace Clearance. Any portion of a masonry fireplace located in the interior of a building or within the exterior wall of a building shall have a clearance to combustibles of not less than two inches (51 mm) from the front faces and sides of masonry fireplaces and not less than 4 inches (102 mm) from the back faces of masonry fireplaces. The air space shall not be filled, except to provide fire blocking in accordance with 780 CMR 2111.13.

Exceptions:

1. Masonry fireplaces listed and labeled for use in accordance with UL 127, and installed in accordance with the manufacturer's installation instructions, are permitted to have combustible material in contact with their exterior surfaces.
2. When masonry fireplaces are constructed as part of masonry or concrete walls, combustible materials shall not be in contact with the masonry or concrete walls less than 12 inches (306 mm) from the inside surface of the nearest firebox lining.
3. Exposed combustible trim and the edges of sheathing materials, such as wood siding, flooring and drywall, are permitted to abut the masonry fireplace side walls and hearth extension, in accordance with Figure 2111.11, provided such combustible trim or sheathing is a minimum of 12 inches (306 mm) from the inside surface of the nearest firebox lining.
4. Exposed combustible mantels or trim is permitted to be placed directly on the masonry fireplace front surrounding the fireplace opening provided such combustible materials shall not be placed within six inches (153 mm) of the fireplace opening. Combustible materials within 12 inches (306 mm) of the fireplace opening shall not project more than ⅛-inch (3.2mm) for each one-inch (25 mm) distance from such opening.

FIGURE 2111.11 ILLUSTRATION OF EXCEPTION TO FIREPLACE CLEARANCE PROVISION


masonry
combustible sheathing edge abutting masonry 12" min. from firebox
2" clearance (air space) to combustible framing
frame wall
wood mantel

For SI: 1 inch - 25.4 mm

2111.12 Mantel and Trim. Woodwork or other combustible materials shall not be placed within six inches (152 mm) of a fireplace opening. Combustible material within 12 inches (305 mm) of the fireplace opening shall not project more than ⅛ inch (3.2 mm) for each one-inch (25 mm) distance from such opening.

2111.13 Fireplace Fire Blocking. All spaces between fireplaces and floors and ceilings through which fireplaces pass shall be fire blocked with noncombustible material securely fastened in place. The fire blocking of spaces between wood joists, beams or headers shall be to a depth of one inch (25 mm) and shall only be placed on strips of metal or metal lath laid across the spaces between combustible material and the chimney.

2111.14 Exterior Air. Factory-built or masonry fireplaces covered in 780 CMR 2111.14 shall be equipped with an exterior air supply to ensure proper fuel combustion unless the room is mechanically ventilated and controlled so that the indoor pressure is neutral or positive.

2111.14.1 Factory-built Fireplaces. Exterior combustion air ducts for factory-built fireplaces shall be a listed component of the fireplace and shall be installed according to the fireplace manufacturer's instructions.

2111.14.2 Masonry Fireplaces. Listed combustion air ducts for masonry fireplaces shall be installed according to the terms of their listing and manufacturer=s instructions.

2111.14.3 Exterior Air Intake. The exterior air intake shall be capable of providing all combustion air from the exterior of the dwelling. The exterior air intake shall not be located within the garage, attic, basement or crawl space of the dwelling nor shall the air intake be located at an elevation higher than the firebox. The exterior air intake shall be covered with a corrosion-resistant screen of ¼-inch (6.4 mm) mesh.

2111.14.4 Clearance. Unlisted combustion air ducts shall be installed with a minimum one-inch (25 mm) clearance to combustibles for all parts of the duct within five feet (1524 mm) of the duct outlet.

2111.14.5 Passageway. The combustion air passageway shall be a minimum of six square inches (3870 mm^2) and not more than 55 square inches (0.035 m^2), except that combustion air systems for listed fireplaces or for fireplaces tested for emissions shall be constructed according to the fireplace manufacturer=s instructions.

2111.14.6 Outlet. The exterior air outlet is permitted to be located in the back or sides of the firebox chamber or within 24 inches (610 mm) of the firebox opening on or near the floor. The outlet shall be closable and designed to prevent burning material from dropping into concealed combustible spaces.

780 CMR 2112.0 MASONRY HEATERS

2112.1 Definition. A masonry heater is a heating appliance constructed of concrete or solid masonry, hereinafter referred to as masonry, having a mass of at least 1,760 pounds (800 kg) excluding the chimney and foundation, which is designed to absorb and store heat from a solid fuel fire built in the firebox by routing the exhaust gases through internal heat exchange channels in which the flow path downstream of the firebox includes at least one 180 degree (3.14 rad) change in flow direction before entering the chimney, and that delivers heat by radiation from the masonry surface of the heater that shall not exceed 230°F (110°C) except within eight inches (203 mm) surrounding the fuel loading door(s).

2112.2 Installation. Masonry heaters shall be listed or installed in accordance with ASTM E 1602.

2112.3 Seismic Reinforcing. Seismic reinforcing shall not be required within the body of a masonry heater whose height is equal to or less than 2.5 times its body width and where the masonry chimney serving the heater is not supported by the body of the heater. Where the masonry chimney shares a common wall with the facing of the masonry heater, the chimney portion of the structure shall be reinforced in accordance with 780 CMR 2113.0 and 2113.4.

2112.4 Masonry Heater Clearance. Wood or other combustible framing shall not be placed within four inches (102 mm) of the outside surface of a masonry heater, provided the wall thickness of the firebox is not less than eight inches (203 mm) and the wall thickness of the heat exchange channels is not less than five inches (127 mm). A clearance of at least eight inches (203 mm) shall be provided between the gas tight capping slab of the heater and a combustible ceiling. The required space between the heater and combustible material shall be fully vented to permit the free flow of air around all heater surfaces.

780 CMR 2113.0 MASONRY CHIMNEYS

2113.1 General. A masonry chimney is a chimney constructed of concrete or masonry, hereinafter referred to as masonry. Masonry chimneys shall be constructed, anchored, supported and reinforced as required in 780 CMR 21.00.

2113.2 Footings and Foundations. Foundations for masonry chimneys shall be constructed of concrete or solid masonry at least 12 inches (305 mm) thick and shall extend at least six inches (152 mm) beyond the face of the foundation or support wall on all sides. Footings shall be founded on natural undisturbed earth or engineered fill below frost depth.

2113.3 Seismic Reinforcing. Masonry or concrete chimneys shall be constructed, anchored, supported and reinforced as required in this chapter. Masonry and concrete chimneys shall be reinforced and anchored as detailed in 780 CMR 2113.3.1 and 2113.3.2.

2113.3.1 Vertical Reinforcing. For chimneys up to 40 inches (1016 mm) wide, four No. 4 continuous vertical bars anchored in the foundation shall be placed in the concrete, between wythes of solid masonry or within the cells of hollow unit masonry and grouted. Grout shall be prevented from bonding with the flue liner so that the flue liner is free to move with thermal expansion. For chimneys greater than 40 inches (1016 mm) wide, two additional No. 4 vertical bars shall be provided for each additional 40 inches (1016 mm) in width or fraction thereof.

2113.3.2 Horizontal Reinforcing. Vertical reinforcement shall be placed enclosed within ¼-inch (6.4 mm) ties, or other reinforcing of equivalent net cross-sectional area, spaced not to exceed 18 inches (457 mm) on center in concrete, or placed in the bed joints of unit masonry, at a minimum of every 18 inches (457 mm) of vertical height. Two such ties shall be provided at each bend in the vertical bars.

2113.4 Seismic Anchorage. Masonry and concrete chimneys and foundations in shall be anchored at each floor, ceiling or roof line more than six feet (1829 mm) above grade, except where constructed completely within the exterior walls. Anchorage shall conform to the following requirements.

2113.4.1 Anchorage. Two $^3/_{16}$-inch by one-inch (4.8 mm by 25.4 mm) straps shall be embedded a minimum of 12 inches (305 mm) into the chimney. Straps shall be hooked around the outer bars and extend six inches (152 mm) beyond the bend. Each strap shall be fastened to a minimum of four floor joists with two ½-inch (12.7 mm) bolts.

2113.5 Corbelling. Masonry chimneys shall not be corbelled more than half of the chimney's wall thickness from a wall or foundation, nor shall a chimney be corbelled from a wall or foundation that is less than 12 inches (305 mm) in thickness unless it projects equally on each side of the wall, except that on the second story of a two-story dwelling, corbelling of chimneys on the exterior of the enclosing walls is permitted to equal the wall thickness. The projection of a single course shall not exceed ½ the unit height or ⅓ of the unit bed depth, whichever is less.

2113.6 Changes in Dimension. The chimney wall or chimney flue lining shall not change in size or shape within six inches (152 mm) above or below where the chimney passes through floor components, ceiling components or roof components.

2113.7 Offsets. Where a masonry chimney is constructed with a fireclay flue liner surrounded by one wythe of masonry, the maximum offset shall be such that the centerline of the flue above the offset does not extend beyond the center of the chimney wall below the offset. Where the chimney offset is supported by masonry below the offset in an approved manner, the maximum offset limitations shall not apply. Each individual corbelled masonry course of the offset shall not exceed the projection limitations specified in 780 CMR 2113.2.

2113.8 Additional Load. Chimneys shall not support loads other than their own weight unless they are designed and constructed to support the additional load. Masonry chimneys are permitted to be constructed as part of the masonry walls or concrete walls of the building

.

2113.9 Termination. Chimneys shall extend at least two feet (610 mm) higher than any portion of the building within ten feet (3048 mm), but shall not be less than three feet (914 mm) above the highest point where the chimney passes through the roof.

2113.9.1 Spark Arrestors. Where a spark arrestor is installed on a masonry chimney, the spar arrestor shall meet all of the following requirements:

1. The net free area of the arrestor shall not be less than four times the net free area of the outlet of the chimney flue it serves.
2. The arrestor screen shall have heat and corrosion resistance equivalent to 19 gage galvanized steel or 24 gage stainless steel
3. Openings shall not permit the passage of spheres having a diameter greater than ½ inch (13 mm) nor block the passage of sphere having a diameter of less than ⅜-inch (11 mm).
4. The spark arrestor shall be accessible for cleaning and the screen or chimney cap shall be removable to allow for cleaning of the flue.

2113.10 Wall Thickness. Masonry chimney walls shall be constructed of concrete, solid masonry units, or hollow masonry units grouted solid with not less than four inches (102 mm) nominal thickness.

2113.11 Flue Lining (Material). Masonry chimneys shall be lined. The lining material shall be appropriate for the type of appliance connected, according to the terms of the appliance listing and manufacturer's instructions.

2113.11.1 Residential-type Appliances (General). Flue lining systems shall comply with one of the following:

1. Clay flue lining complying with the requirements of ASTM C 315, Specifications for Clay Flue Linings, or equivalent.
2. Listed chimney lining systems complying with UL 1777, Chimney Liners.
3. Factory-built chimneys or chimney units listed for installation within masonry chimneys.
4. Other approved materials that will resist corrosion, erosion, softening, or cracking from flue gasses and condensate at temperatures up to 1,800° F (982° C).

2113.11.1.1 Flue Linings for Specific Appliances. Flue linings other than covered in 780 CMR 2113.11.1 intended for use with specific appliances shall comply with780 CMR 2113.11.1.2 through 2113.11.1.4 and 780 CMR 2113.11.2 and 2113.11.3.

2113.11.1.2 Gas Appliances. Flue lining systems for gas appliances shall be in accordance with 248 CMR.

2113.11.1.3 Pellet Fuel-burning Appliances. Flue lining and vent systems for use in masonry chimneys with pellet fuel-burning appliances shall be limited to flue lining systems complying with 780 CMR 2113.11.1 and pellet vents listed for installation within masonry chimneys. (See 780 CMR 2113.11.1.5 for marking.)

2113.11.1.4 Oil-fired Appliances Approved for Use with L-vent. Flue lining and vent systems for use in masonry chimneys with oil-fired appliances approved for use with Type L vent shall be limited to flue lining systems complying with 780 CMR 2113.11.1 and listed chimney liners complying with UL 641. (See 780 CMR 2113.11.1.5 for marking.)

2113.11.1.5 Notice of Usage. When a flue is relined with a material not complying with 780 CMR 2113.11.1, the chimney shall be plainly and permanently identified by a label attached to a wall ceiling or other conspicuous location adjacent to where the connector enters the chimney. The label shall include the following message or equivalent language: "This chimney is for use only with (Type or category of appliance) that burns (type of fuel). Do not connect other types of appliances."

2113.11.2 Concrete and Masonry Chimneys for Medium Heat Appliances.

2113.11.2.1 General. Concrete and masonry chimneys for medium-heat appliances shall comply with 780 CMR 2113.1 through 2113.5.

2113.11.2.2 Construction. Chimneys for medium-heat appliances shall be constructed of solid masonry units or of concrete with walls a minimum of eight inches (203 mm) thick, or with stone masonry a minimum of 12 inches (305 mm) thick.

2113.11.2.3 Lining. Concrete and masonry chimneys shall be lined with an approved medium-duty refractory brick a minimum of 4½ inches (114 mm) thick laid on the 4½-inch bed (114 mm) in an approved medium-duty refractory mortar. The lining shall start two feet (610 mm) or more below the lowest chimney connector entrance. Chimneys terminating 25 feet (7620 mm) or less above a chimney connector entrance shall be lined to the top.

2113.11.2.4 Multiple Passageway. Concrete and masonry chimneys containing more than one passageway shall have the liners separated by a minimum four-inch-thick (102 mm) concrete or solid masonry wall.

2113.11.2.5 Termination Height. Concrete and masonry chimneys for medium-heat appliances shall extend a minimum of ten feet (3048 mm) higher than any portion of any building within 25 feet (7620 mm).

2113.11.2.6 Clearance. A minimum clearance of four inches (102 mm) shall be provided between the exterior surfaces of a concrete or masonry chimney for medium-heat appliances and combustible material.

2113.11.3 Concrete and Masonry Chimneys for High-heat Appliances.

2113.11.3.1 General. Concrete and masonry chimneys for high-heat appliances shall comply with 780 CMR 2113.1 through 2113.5.

2113.11.3.2 Construction. Chimneys for high-heat appliances shall be constructed with double walls of solid masonry units or of concrete, each wall to be a minimum of eight inches (203 mm) thick with a minimum air space of two inches (51 mm) between the walls.

2113.11.3.3 Lining. The inside of the interior wall shall be lined with an approved high-duty refractory brick, a minimum of 4½ inches (114 mm) thick laid on the 4½-inch bed (114 mm) in an approved high-duty refractory mortar. The lining shall start at the base of the chimney and extend continuously to the top.

2113.11.3.4 Termination Height. Concrete and masonry chimneys for high-heat appliances shall extend a minimum of 20 feet (6096 mm) higher than any portion of any building within 50 feet (15240 mm).

2113.11.3.5 Clearance. Concrete and masonry chimneys for high-heat appliances shall have approved clearance from buildings and structures to prevent overheating combustible materials, permit inspection and maintenance operations on the chimney, and prevent danger of burns to persons.

2113.12 Flue Lining (Installation). Flue liners shall be installed in accordance with ASTM C 1283 and extend from a point not less than eight inches (203 mm) below the lowest inlet or, in the case of fireplaces, from the top of the smoke chamber, to a point above the enclosing walls. The lining shall be carried up vertically, with a maximum slope no greater than 30 degrees from the vertical.

Fireclay flue liners shall be laid in medium-duty refractory mortar conforming to ASTM C 199, with tight mortar joints left smooth on the inside and installed to maintain an air space or insulation not to exceed the thickness of the flue liner separating the flue liners from the interior face of the chimney masonry walls. Flue lining shall be supported on all sides. Only enough mortar shall be placed to make the joint and hold the liners in position.

2113.13 Additional Requirements.

2113.13.1 Listed Materials. Listed materials used as flue linings shall be installed in accordance with the terms of their listings and manufacturer's instructions.

2113.13.2 Space Around Lining. The space surrounding a chimney lining system or vent installed within a masonry chimney shall not be used to vent any other appliance.

Exception. This shall not prevent the installation of a separate flue lining in accordance with the manufacturer's installation instructions.

2113.14 Multiple Flues. When two or more flues are located in the same chimney, masonry wythes shall be built between adjacent flue linings. The masonry wythes shall be at least four inches (102 mm) thick and bonded into the walls of the chimney.

Exception. When venting only one appliance, two flues are permitted to adjoin each other in the same chimney with only the flue lining separation between them. The joints of the adjacent flue linings shall be staggered at least four inches (102 mm).

2113.15 Flue Area (Appliance). Chimney flues shall not be smaller in area than of the area of the connector from the appliance. Chimney flues connected to more than one appliance shall not be less than the area of the largest connector plus 50% of the areas of the additional chimney connectors.

Exceptions:

1. Chimney flues serving oil-fired appliances sized in accordance with NFPA 31.
2. Chimney flues serving gas-fired appliances sized in accordance with the International Fuel Gas Code.

2113.16 Flue Area (Masonry Fireplace). Flue sizing for chimneys serving fireplaces shall be in accordance with 780 CMR 2113.16.1 or 780 CMR 2113.16.2.

2113.16.1 Minimum Area. Round chimney flues shall have a minimum net cross-sectional area of at least $^1/_{12}$ of the fireplace opening. Square chimney flues shall have a minimum net cross-sectional area of at least $^1/_{10}$ of the fireplace opening. Rectangular chimney flues with an aspect ratio less than two to one shall have a minimum net cross-sectional area of at least $^1/_{10}$ of the fireplace opening. Rectangular chimney flues with an aspect ratio of two to one or more shall have a minimum net cross-sectional area of at least ⅛ of the fireplace opening.

2113.16.2 Determination of Minimum Area. The minimum net cross-sectional area of the flue shall be determined in accordance with Figure 2113.16. A flue size providing at least the equivalent net cross-sectional area shall be used. Cross-sectional areas of clay flue linings are provided in Tables 2113.16(1) and 2113.16(2) or as provided by the manufacturer or as measured in the field. The height of the chimney shall be measured from the firebox floor to the top of the chimney flue.

TABLE 2113.16(1) NET-CROSS SECTIONAL AREA OF ROUND FLUE SIZES[a]

FLUE SIZE, INSIDE DIAMETER (inches)	CROSS-SECTIONAL AREA (square inches)
6	28
7	38
8	50
10	78
10¾	90
12	113
15	176
18	254

For SI: 1 inch = 25.4 mm, 1 square inch - 345.16 mm².

a. Flue sizes are based on ASTM C 315.

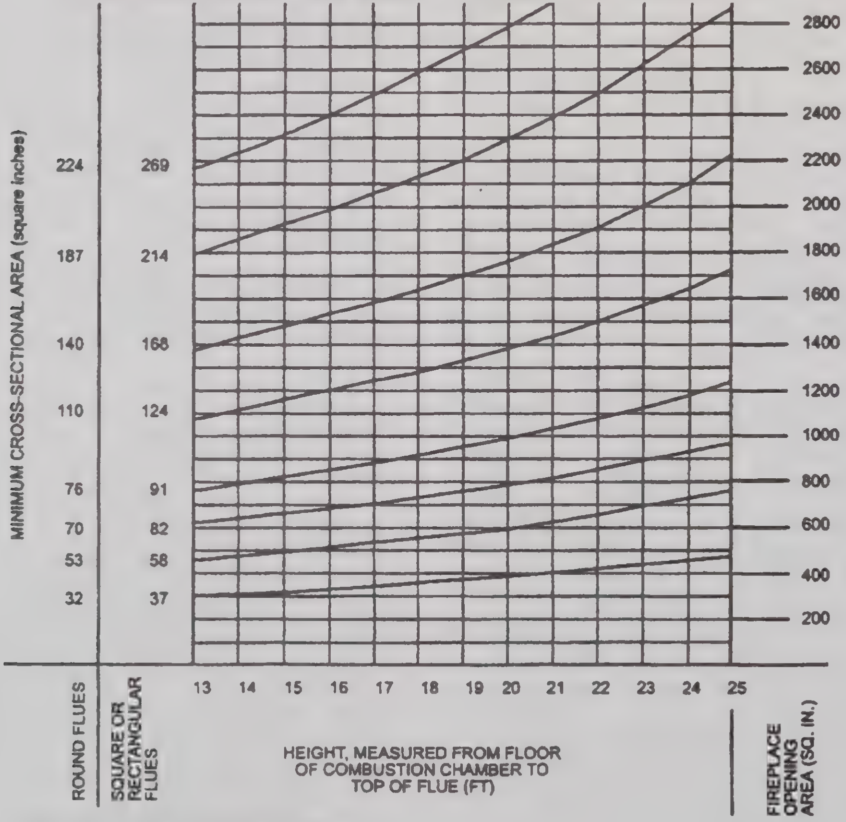
TABLE 2113.16(2) NET-CROSS SECTIONAL AREA OF SQUARE AND RECTANGULAR FLUE SIZES[a]

FLUE SIZE, INSIDE DIMENSION (inches)	CROSS-SECTIONAL AREA (square inches)
4½ x 13	34
7½ x 7½	37
8½ x 8½	47
7½ x 11½	58
8½ x 13	74
7½ x 15½	82
11½ x 11½	91
8½ x 17½	101
13x 13	122
11½ x 15½	124
13x 17½	165
15½ x 15½	168
15½ x 19½	214
17½ x 17½	226
19½ x 19½	269
20x 20	286

For SI: 1 inch = 25.4 mm, 1 square inch - 345.16 mm².

a. Flue sizes are based on ASTM C 315.

FIGURE 2113.16 FLUE SIZES FOR MASONRY CHIMNEYS



For SI: 1 inch = 25.4 mm, 1 square inch = 645 mm².

2113.17 Inlet. Inlets to masonry chimneys shall enter from the side. Inlets shall have a thimble of fireclay, rigid refractory material or metal that will prevent the connector from pulling out of the inlet or from extending beyond the wall of the liner.

2113.18 Masonry Chimney Cleanout Openings. Cleanout openings shall be provided within six inches (152 mm) of the base of each flue within every masonry chimney. The upper edge of the cleanout shall be located at least six inches (152 mm) below the lowest chimney inlet opening. The height of the opening shall be at least six inches (152 mm). The cleanout shall be provided with a noncombustible cover.

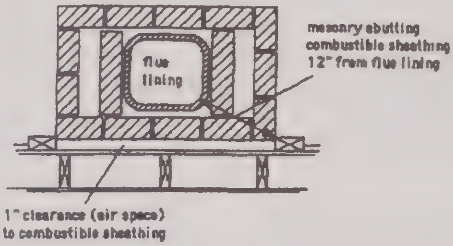
Exception. Chimney flues serving masonry fireplaces, where cleaning is possible through the fireplace opening.

2113.19 Chimney Clearances. Any portion of a masonry chimney located in the interior of the building or within the exterior wall of the building shall have a minimum air space clearance to combustibles of 2 inches (51 mm). Chimneys located entirely outside the exterior walls of the building, including chimneys that pass through the soffit or cornice, shall have a minimum air space clearance of one inch (25 mm). The air space shall not be filled, except to provide fire blocking in accordance with 780 CMR 2113.20.

Exceptions.

1. Masonry chimneys equipped with a chimney lining system listed and labeled for use in chimneys in contact with combustibles in accordance with UL 1777, and installed in accordance with the manufacturer's installation instructions, are permitted to have combustible material in contact with their exterior surfaces.
2. Where masonry chimneys are constructed as part of masonry or concrete walls, combustible materials shall not be in contact with the masonry or concrete wall less than 12 inches (306 mm) from the inside surface of the nearest flue lining.
3. Exposed combustible trim and the edges of sheathing materials, such as wood siding, are permitted to abut the masonry chimney side walls, in accordance with Figure 2113.19, provided such combustible trim or sheathing is a minimum of 12 inches (306 mm) from the inside surface of the nearest flue lining. Combustible material and trim shall not overlap the corners of the chimney by more than one inch (25 mm).

FIGURE 2113.19 ILLUSTRATION OF EXCEPTION TO CHIMNEY CLEARANCE PROVISION



For SI: 1 inch - 25.4 mm

2113.20 Chimney Fire Blocking. All spaces between chimneys and floors and ceilings through which chimneys pass shall be fire blocked with noncombustible material securely fastened in place. The fire blocking of spaces between wood joists, beams or headers shall be to a depth of one inch (25 mm) and shall only be placed on strips of metal or metal lath laid across the spaces between combustible material and the chimney.

NON-TEXT PAGE

STEEL

780 CMR 2201.0 GENERAL

2201.1 Scope. The provisions of 780 CMR 22.00 shall govern the materials, quality, design, fabrication and erection of steel used structurally in buildings or structures.

780 CMR 2202.0 DEFINITIONS AND NOMENCLATURE

2202.1 Definitions. The following words and terms shall, for the purposes of 780 CMR 22.00 and as used elsewhere in 780 CMR, have the meaning shown in 780 CMR 2202.1.

ADJUSTED SHEAR RESISTANCE. In Type II shear walls, the unadjusted shear resistance multiplied by the shear resistance adjustment factors of Table 2211.3.

STEEL CONSTRUCTION, COLD-FORMED. That type of construction made up entirely, or in part, of steel structural members cold formed to shape from sheet or strip steel such as roof deck, floor and wall panels, studs, floor joists, roof joists and other structural elements.

STEEL JOIST. Any steel structural member of a building or structure made of hot-rolled or cold-formed solid or open-web sections, or riveted or welded bars, strip or sheet steel members, or slotted and expanded, or otherwise deformed rolled sections.

STEEL MEMBER, STRUCTURAL. Any steel structural member of a building or structure consisting of a rolled steel structural shape other than cold-formed steel, or steel joist members.

TYPE I SHEAR WALL. A wall designed to resist in-plane lateral forces that is fully sheathed and provided with hold-down anchors at each end of the wall segment. Type I walls are permitted to have openings where detailing for force transfer around the openings is provided (see Figure 2202.1).

TYPE II SHEAR WALL. A wall designed to resist in-plane lateral forces that is sheathed with wood structural panel or sheet steel that contains openings, that have not been specifically designed and detailed for force transfer around wall openings. Hold-down anchors for Type II shear walls are only required at the ends of the wall (*see* Figure 2202.1).

TYPE II SHEAR WALL SEGMENT. A section of shear wall with full-height sheathing and which meets the aspect ratio limits of 780 CMR 2211.3.2(3).

UNADJUSTED SHEAR RESISTANCE. In Type II walls, the unadjusted shear resistance is based on the design shear and the limitations of 780 CMR 2211.3.1.

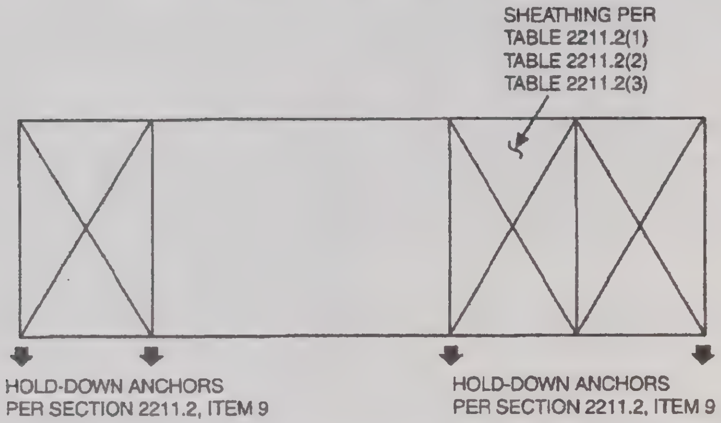
2202.2 Nomenclature. The following symbols shall, for the purposes of 780 CMR 22.00 and as used elsewhere in 780 CMR, have the meaning shown in 780 CMR 2202.2.

ϕ= Resistance factor.
Ω = Factor of safety.
Ω_O = System overstrength factor (see 780 CMR 1615).
C_o = Shear resistance adjustment factor from Table 2211.3.
ΣL_i = Sum of widths of Type II shear wall segments, feet (mm/1,000).
C = Compression chord uplift force, lbs (kN).
V = Shear force in Type II shear wall, lbs (kN).
h = The height of a shear wall or wall pier measured as:

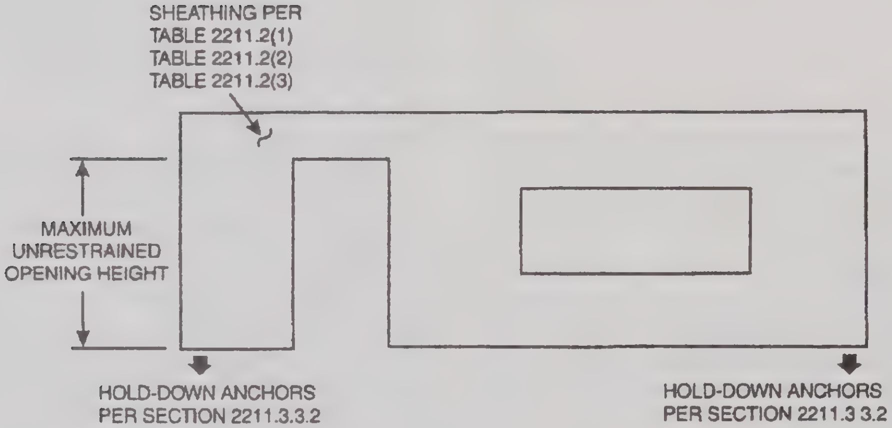
1. For a shear wall, the maximum clear height from top of foundation to bottom of diaphragm framing above or, the maximum clear height from top of a diaphragm to bottom of diaphragm framing above.
2. For a wall pier, the clear height of the shortest adjacent opening

v = Unit shear force, plf (kN/m).
w = The width of a shear wall or wall pier in the direction of application of force measured as the sheathed dimension of the shear wall.

FIGURE 2002.1 TYPE I AND II SHEAR WALLS


SHEATHING PER
TABLE 2211.2(1)
TABLE 2211.2(2)
TABLE 2211.2(3)
HOLD-DOWN ANCHORS
PER SECTION 2211.2, ITEM 9
HOLD-DOWN ANCHORS
PER SECTION 2211.2, ITEM 9

TYPE 1 SHEAR WALL


SHEATHING PER
TABLE 2211.2(1)
TABLE 2211.2(2)
TABLE 2211.2(3)
MAXIMUM
UNRESTRAINED
OPENING HEIGHT
HOLD-DOWN ANCHORS
PER SECTION 2211.3.3.2
HOLD-DOWN ANCHORS
PER SECTION 2211.3 3.2

TYPE II SHEAR WALL

780 CMR 2203.0 IDENTIFICATION

2203.1 Identification. Steel furnished for structural load-carrying purposes shall be properly identified for conformity to the ordered grade in accordance with the specified ASTM standard or other specification and the provisions of 780 CMR 22.00. Steel that is not readily identifiable as to grade from marking and test records shall be tested to determine conformity to such standards.

780 CMR 2204.0: RESERVED

780 CMR 2205.0 STRUCTURAL STEEL

2205.1 General. The design, fabrication and erection of structural steel for buildings and structures shall be in accordance with either AISC-LRFD, AISC 335 or AISC-HSS. Where required, the seismic design of steel structures shall be in accordance with the additional provisions of 780 CMR 2205.3.

2205.2 Shop Drawings. Complete shop drawings shall be prepared in compliance with the best modern practice in advance of the actual fabrication. Such drawings shall clearly distinguish between shop and field rivets, bolts and welds in all connections and details, and shall also clearly identify steel grades, bolt types and sizes, weld types and sizes, locations and dimensions and all information necessary for proper fabrication and installation of the steel members.

2205.3 Seismic Requirements for Steel Structures. The design of structural steel structures to resist seismic forces shall be in accordance with the provisions of 780 CMR 2205.3 for the appropriate seismic design category. Seismic Design Categories A, E and F are not applicable in Massachusetts. The provisions of AISC 341 are fully applicable to all structural steel structures in Massachusetts, regardless of Seismic Design Category, except as noted otherwise in 780 CMR 2205.3.

2205.3.1 Seismic Design Category B or C. Structural steel structures assigned to Seismic Design Category B or C in accordance with 780 CMR 1615.0 shall be of any construction permitted in 780 CMR 1615.0, Table 9.5.2.2. An *R* factor as set forth in 780 CMR 1615.0, Table 9.5.2.2 for the appropriate steel system is permitted where the structure is designed and detailed in accordance with the provisions of AISC 341, Parts I and III. Systems not detailed in accordance with the above shall comply with the requirements for "8. Structural Steel Systems Not Specifically Detailed For Seismic Resistance" in 780 CMR 1615.0, Table 9.5.2.2, and the connections resisting seismic forces shall be designed for two times the computed forces and moments resulting from seismic load in combination with other loads, as applicable.

2205.3.2 Seismic Design Category D. Structural steel structures assigned to Seismic Design Category D shall be designed and detailed in accordance with AISC 341, Part I.

2205.3.3 Special Concentric Braced Frames. The following revisions to AISC 341 shall apply to Part I Section 13 Special Concentric Braced Frames (SCBF):

13.2 Bracing Members.

13.2a Slenderness. Bracing members shall have $Kl/r \leq 4\sqrt{E_s/F_y}$

Exception. Braces with $4\sqrt{E_s/F_y} < Kl/r \leq 200$ are permitted in frames in which the available strength of the column is at least equal to the maximum load transferred to the column considering R_y (LRFD) or $(1/1.5)R_y$ (ASD), as appropriate, times the nominal strength of the connecting brace elements of the building. Column forces need not exceed those determined by inelastic analysis, nor the maximum load effects that can be developed by the system.

13.4a V-Type and Inverted-V-Type Bracing. Revise clause (4) as follows:

(4) Both flanges of the beam shall be laterally braced, with a maximum spacing of $L_b = L_{pd}$, as specified by Equations F1-17 and F1-18 of the AISC LRFD Specification. Lateral bracing shall meet the provisions of Section C3.4a Lateral Bracing, for Nodal Bracing, using $C_d = 1.0$, of the AISC LRFD Specification. As a minimum, one set of lateral braces is required at the point of intersection of the V-type (or Inverted-V-type) bracing, unless the beam has sufficient out-of-plane strength and stiffness to insure stability between adjacent brace points.

2205.3.4 Ordinary Concentric Braced Frames. The following revisions to AISC 341 shall apply to Part I Section 14 Ordinary Concentric Braced Frames (OCBF).

14.2 Strength Delete existing text and replace with the following:

14.2 Bracing Members Bracing members shall meet the requirements of Section 8.2.

Exception. HSS braces that are filled with concrete need not comply with this provision.

Bracing members in V, or inverted-V configurations shall have $Kl/r \leq 4\sqrt{E_s/F_y}$.

14.3 Add new paragraph as follows:

14.3 Special Bracing Configuration Requirements K-Type braced frames are not permitted for OCBF.

Beams in V-type and inverted-V-type OCBF shall be continuous at bracing connections away from the beam-column connection and shall meet the following requirements:

(1) The required strength shall be determined based on the load combinations of the applicable building code assuming that the braces provide no support of dead and live loads. For load combinations that include earthquake effects, the earthquake effect, E, on the member shall be determined as follows:

(a) The forces in braces in tension shall be assumed to be equal to $R_yF_yA_g$. For V-type and inverted-V-type OCBF, the forces in braces in tension need not exceed the maximum force that can be developed by the system.

(b) The forces in braces in compression shall be assumed to be equal to $0.3P_n$.

(2) Both flanges of the beam shall be laterally braced, with a maximum spacing of $L_b = L_{pd}$, as specified by Equations F1-17 and F1-18 of the AISC LRFD Specification. Lateral bracing shall meet the provisions of Section C3.4a Lateral Bracing, for Nodal Bracing, using C_d=1.0, of the AISC LRFD Specification. As a minimum, one set of lateral braces is required at the point of intersection of the V-type (or inverted-V-type) bracing ,unless the beam has sufficient out-of-plane strength and stiffness to insure stability between adjacent brace points.

14.4 Add new paragraph as follows:

> **14.4 Bracing Connections** The required strength of bracing connections shall be determined as follows:
>
> (1) For the limit state of bolt slip, the required strength of bracing connections shall be that determined using the load combinations stipulated by the applicable building code, not including the amplified seismic load.
>
> (2) For other limit states, the required strength of bracing connections is the expected yield strength, in tension, of the brace, determined as $R_yF_yA_g$. (LRFD) or $R_yF_yA_g$./1.5 (ASD), as appropriate.
>
> **Exception**. The required strength of the brace connection need not exceed either of the following:
>
> (a) The maximum force that can be developed by the system.
>
> (b) A load effect based upon using the amplified seismic load.

2205.4 Seismic Requirements for Composite Construction. The design, construction and quality of composite steel and concrete components that resist seismic forces shall conform to the requirements of the AISC LRFD and ACI 318. The design of such systems shall also conform to the requirements of AISC 341, Part II.

2205.4.1 Seismic Design Category D. Composite structures are permitted in Seismic Design Category D, subject to the limitations in 780 CMR 1615.0, where substantiating evidence is provided to demonstrate that the proposed system will perform as intended by AISC 341, Part II. The substantiating evidence shall be subject to building official approval. Where composite elements or connections are required to sustain inelastic deformations, the substantiating evidence shall be based on cyclic testing.

780 CMR 2206.0 STEEL JOISTS

2206.1 General. The design, manufacturing and use of open web steel joists and joist girders shall be in accordance with one of the following Steel Joist Institute specifications.

1. SJI K-1.1.
2. LH/DLH-1.1.
3. JG-1.1.

Where steel joists and/or joist girders are part of the building's seismic load resisting system, the provisions of 780 CMR 2205.3 or 2211.0 shall apply.

780 CMR 2207 STEEL CABLE STRUCTURES

2207.1 General:. The design, fabrication, and erection including related connections, and protective coatings of steel cables for buildings shall be in accordance with ASCE 19.

2207.2 Seismic Requirements for Steel Cable: The design strength of steel cables shall be determined by the provisions of ASCE 19 except as modified by these provisions.

1. A load factor of 1.1 shall be applied to the prestress force included in T_3 and T_4 as defined in Section 3.12.
2. In Section 3.2.1, Item (c) shall be replaced with "1.5 T_3" and Item (d) shall be replaced with "1.5 T_4".

780 CMR 2208.0 STEEL STORAGE RACKS

2208.1 Storage Racks. The design, testing and utilization of industrial steel storage racks shall be in accordance with the *RMI Specification for the Design, Testing and Utilization of Industrial Steel Storage Racks*. Racks in the scope of this specification include industrial pallet racks, movable shelf racks and stacker racks, and does not apply to other types of racks, such as drive-in and drive-through racks, cantilever racks, portable racks or rack buildings. The seismic design of storage racks shall be in accordance with the provisions of ASCE 7, Section 9.6.2.9.

780 CMR 2209.0 COLD-FORMED STEEL

2209.1 General. The design of cold-formed carbon and low alloy steel structural members shall be in accordance with AISI-NASPEC. The design of cold-formed stainless steel structural members shall be in accordance with ASCE 8. Cold-formed steel light-framed construction shall comply with 780 CMR 2210.0.

2209.2 Composite slabs on steel decks. Composite slabs of concrete and steel deck shall be designed and constructed in accordance with ASCE 3.

2209.3 Seismic Requirements for Steel Deck Diaphragms. The provisions of ASCE 7, Section A9.8.7 are applicable.

2209.4 Protection. Formed steel shall be protected in accordance with 780 CMR 2209.4.1 through 2209.4.4.

2209.4.1 Shop Coat. All individual structural members and assembled panels of light gage and formed steel construction, except where fabricated of approved corrosion-resistant metallic steel or of steel having a corrosion-resistant or other approved coating, shall be protected against corrosion with an approved shop coat of paint, enamel or other approved protection.

2209.4.2 Field Coat. After erection where directly exposed to the weather, except where encased in concrete made of non-corrosive aggregates, or where fabricated of approved corrosion-resistant steel, or of galvanized or otherwise adequately protected steel, individual structural members and assembled panels of light gage and formed steel construction shall be given an additional coat of approved protection.

2209.4.3 Siding. Exposed siding or sheeting shall be fabricated of approved corrosion-resistant steel or otherwise protected at the ground level for sufficient height above grade as determined by the depth of average snowfall in the locality, but not less than eight inches (203 mm).

2209.4.4 Protection at Exterior Walls. Floor or roof construction which extends into an exterior wall shall be adequately waterproofed and protected from the weather to prevent corrosion.

2209.5 Tests. Where not capable of design by engineering analysis, tests of the individual or assembled structural units and the connections shall be performed as prescribed in 780 CMR 1626.0 and 1629.0.

2209.6 Identification. Each structural member, siding panel, and roof panel of a metal building system, other than hardware items such as bolts, nuts, washers, shims, and rivets, shall be identified by the manufacturer. The identification shall include the manufacturer's name or logo, and the part number or part name consistent with assembly instructions.

780 CMR 2210.0 COLD-FORMED STEEL LIGHT-FRAMED CONSTRUCTION

2210.1 General. The design, installation and construction of cold-formed carbon or low-alloy steel, structural and nonstructural steel framing, shall be in accordance with AISI-General) and AISI-NASPEC.

2210.2 Headers. The design and installation of cold-formed steel box and back-to-back headers, and double L-headers used in single-span conditions for load- carrying purposes shall be in accordance with AISI-Header, subject to the limitations therein.

2210.3 Trusses. The design, quality assurance, installation and testing of cold-formed steel trusses shall be in accordance with AISI-Truss, subject to the limitations therein.

780 CMR 2211.0 COLD-FORMED STEEL LIGHT-FRAMED SHEAR WALLS

2211.1 General. In addition to the requirements of 780 CMR 2210.0, the design of cold-formed steel light-framed shear walls, to resist wind and seismic loads shall be in accordance with the requirements of 780 CMR 2211.2 for Type I (segmented) shear walls or 780 CMR 2211.3 for Type II (perforated) shear walls.

The lateral design of light-framed structures for seismic forces shall also comply with the requirements in 780 CMR 2211.4.

2211.2 Type I Shear Walls. The design of Type I shear walls, of cold-formed steel light-framed construction, to resist wind and seismic loads, shall be in accordance the requirements of 780 CMR 2211.2.

1. The nominal shear value for Type I shear walls, as shown in Table 2211.2(1) for wind loads, Table 2211.2(2) for wind or seismic loads or Table 2211.2(3) for seismic loads, is permitted to establish allowable shear values or design shear values.
2. Boundary members, chords, collectors and connections thereto shall be proportioned to transmit the induced forces.
3. Type I shear walls sheathed with wood structural or sheet steel panels are permitted to have window openings, between hold-down anchors at each end of a wall segment, where details are provided to account for force transfer around openings.
4. The aspect ratio limitations of 780 CMR 2211.2.2, Item 5., shall apply to the entire Type I segment and to each wall pier at the side of each opening.
5. The height of the wall pier (*h*) shall be defined as the clear height of the pier at the side of an opening.
6. The width of a pier (*w*) shall be defined as the sheathed width of the pier.
7. The width of wall piers shall not be less than 24 inches (102 mm).
8. Hold-down anchors shall be provided at each end of a Type I shear wall capable of resisting the design forces.

2211.2.1 Design Shear Determination. Where allowable stress design (ASD) is used, the allowable shear value shall be determined by dividing the nominal shear value, shown in Tables 2211.2(1), 2211.2(2) and 2211.2(3), by a factor of safety (Ω) of 2.5.

Where load and resistance factor design (LRFD) is used, the design shear value shall be determined by multiplying the nominal shear value, shown in Tables 2211.2(1), 2211.2(2) and 2211.2(3), by a resistance factor (Φ) of 0.55.

2211.2.2 Limitations for Systems. The lateral-resistant systems listed in Tables 2211.2(1), 2211.2(2) and 2211.2(3) shall conform to the following requirements:

1. Studs shall be a minimum 1⅝ inches (41.3 mm) by 3½ inches (89 mm) with a ⅜-inch (9.5 mm) return lip. As a minimum, studs shall be doubled (back to back) at shear wall ends.
2. Track shall be a minimum 1¼ inches (31.8 mm) by 3½ inches (89 mm).
3. Both studs and track shall have a minimum uncoated base metal thickness of 20 gage and shall be of the following grades of structural quality steel: ASTM A 653 SS Grade 33, ASTM A 792 SS Grade 33 or ASTM A 875 SS Grade 33.
4. Fasteners along the edges in shear panels shall be placed not less than $^3/_8$ inch (9.5 mm) in from panel edges.
5. The height-to-width shear wall aspect ratio (*h/w*) of wall systems shall not exceed the values in Tables 2211.2(1), 2211.2(2) and 2211.2(3). Where the limiting ratio of *h/w* is greater than 2:1, the shear values shall be multiplied by 2*w/h*.
6. Panel thicknesses shown are minimums. Panels less than 12 inches (305 mm) wide shall not be used. All panel edges shall be fully blocked.
7. Where horizontal strap blocking is used to provide edge blocking, it shall be a minimum 1½ inches (38 mm) wide and of the same material and equal or greater thickness as the track and studs.
8. The design shear values for shear panels with different nominal shear values applied to the same side of a wall are not cumulative except as permitted in Tables 2211.2(1), 2211.2(2) and 2211.2(3). For walls with material applied to both faces of the same wall, the design shear value of material of the same capacity is cumulative. Where the material nominal shear values are not equal, the design shear value shall be either two times the design shear value of the material with the smaller values or shall be taken as the value of the stronger side, whichever is greater. Summing shear values of dissimilar material applied to opposite faces or to the same wall line is not allowed unless permitted by Table 2211.2.1.

2211.2.2.1 Sheet Steel Sheathing. Steel sheets, attached to cold-formed steel framing, are permitted to resist horizontal forces produced by wind or seismic loads.

1. Steel sheets shall have a minimum base metal thickness as shown in Table 2211.2(1) or 2211.2(3), and shall be of the following grades of structural quality steel: ASTM A653 SS Grade 33, ASTM A792 SS Grade 33 or ASTM A 875 SS Grade 33.
2. Nominal shear values, used to establish the allowable shear value or design shear value, are given in Tables 2211.2(1) for wind loads and 2211.2(3) for seismic loads.
3. Steel sheets are permitted to be applied either parallel or perpendicular to framing. All edges of steel sheets shall be attached to framing members, strap blocking or shall be overlapped and attached to each other with screw spacing as required for edges.
4. Screws used to attach steel sheets shall be a minimum No. 8 modified truss head.

2211.2.2.2 Wood Structural Panel Sheathing. Cold-formed steel framed wall systems, sheathed with wood structural panels, are permitted to resist horizontal forces produced by wind or seismic loads subject to the following:

1. Nominal shear values, used to establish the allowable shear value or design shear value, are given in Tables 2211.2(1), for wind loads, and 2211.2(3), for seismic loads.
2. Wood structural panels shall be either plywood or oriented strand board (OSB), as defined in Chapter 23 or its references, shall comply with DOC PS 1 or PS 2 and shall be manufactured using exterior glue.
3. Wood structural panels shall be attached to steel framing with flat-head self-drilling tapping screws with a minimum head diameter of 0.292 inch (8 mm).
4. Where $^7/_{16}$-inch oriented strand board (OSB) is specified, $^{15}/_{32}$-inch structural 1 sheathing (plywood) is permitted.
5. Structural panels are permitted to be applied either parallel or perpendicular to framing.
6. Increases of the nominal loads shown in Tables 2211.2(1) and 2211.2(3) shall not be permitted for duration of load as permitted in 780 CMR 23.00.

2211.2.2.3 Gypsum Board Panel Sheathing. Cold-formed steel framed wall systems, sheathed with gypsum board, are permitted to resist horizontal forces produced by wind or seismic loads subject to the following:

1. Nominal shear values, used to establish the allowable shear value or design shear value, are given in Table 2211.2(2).
2. The shear values listed in Table 2211.2(2) shall not be cumulative with the shear values of other materials applied to the same wall unless otherwise permitted herein.
3. The nominal shear values shown are for gypsum board that is applied to both sides of the wall.
4. Where gypsum board is only applied to

one side of the wall, the nominal shear values shall be taken as one-half of the value shown.

5. Where gypsum board is applied perpendicular to studs, end joints of adjacent courses of gypsum board sheets shall not occur over the same stud.

6. Screws used to attach gypsum board shall be a minimum No. 6 in accordance with ASTM C 954.

7. The minimum uncoated thickness of light gage framing for shear walls shall be 0.0359 inches.

8. The building shall not be more than 35 feet in height.

9. The shear walls shall not provide lateral load resistance for more than three framed levels (floors or roof). In this context, a pitched roof shall be considered a "level." Where attics are habitable, the pitched roof and attic floor shall be considered separate levels.

10. The location of the shear walls shall be limited to exterior walls, fire walls or fire partitions.

11. The building is not in Seismic Use Group III.

12. The dead load of each level (floor or roof), supported laterally by the shear walls, shall not be more than 25 psf. Where attics are not habitable, the dead load of a pitched roof shall include the dead load of the attic floor.

2211.2.2.4 Sheathing of Other Materials. Cold-formed steel-framed wall systems sheathed with other than steel sheet sheathing, plywood, OSB, or gypsum board panel sheathing shall not be used to resist horizontal forces produced by wind or seismic loads.

TABLE 2211.2(1) NOMINAL SHEAR VALUES FOR WIND FORCES IN POUNDS PER FOOT FOR SHEAR WALLS FRAMED WITH COLD-FORMED STEEL STUDS[a]

ASSEMBLY DESCRIPTION	MAXIMUM HEIGHT/LENGTH RATIO *h/w*	FASTENER SPACING AT PANEL EDGES[b] (inches)				MAXIMUM FRAMING SPACING (inches o.c.)
		6	4	3	2	
$^{15}/_{32}$-inch structural 1 sheathing (4-ply) (plywood) one side.	2:1	1,065[c]	-	-	-	24
$^{7}/_{16}$-inch rated sheathing (OSB), one side	2:1	910[c]	1,410	1,735	1,910	24
$^{7}/_{16}$-inch rated sheathing (OSB), one side, oriented perpendicular to framing	2:1	1,020[c]	-	-	-	24
$^{7}/_{16}$-inch rated sheathing (OSB), one side	4:1[d]	-	1,025	1,425	1,825	24
0.018-inch steel sheet, one side	2:1	485	-	-	-	24
0.027-inch steel sheet, one side	4:1[d]	-	1,000	-	-	24

For SI: 1 inch -25.4 mm, 1 pound per foot = 14.5939 N/m.

a. Nominal shear values shall be multiplied by the resistance factor ϕ to determine design strength or divided by the safety factor Ω to determine allowable shear values as set forth in 780 CMR 2211.2.1.

b. Screws shall be attached to intermediate supports at 12 inches on center unless otherwise shown.

c. Where fully blocked gypsum board is applied to the opposite side of this assembly, in accordance with Table 2211.2(2) with screw spacing at seven inches o.c. edge and seven inches o.c. field, these nominal values are permitted to be increased by 30%.

d. Where aspect ratio (*h/w*) is greater than 2:1, the design shear shall be reduced as required by 780 CMR2211.2.2, item 5.

TABLE 2211.2(2) NOMINAL SHEAR VALUES FOR WIND AND SEISMIC FORCES IN POUNDS PER FOOT FOR SHEAR WALLS FRAMED WITH COLD-FORMED STEEL STUDS AND FACED WITH GYPSUM BOARD[a, b]

WALL CONSTRUCTION	MAXIMUM HEIGHT/LENGTH RATIO *h/w*	ORIENTATION	SCREW SPACING		NOMINAL SHEAR VALUE (plf)
			Edge	Field	
½-inch gypsum board on both sides of wall: studs maximum 24 inches o.c.	2:1	Gypsum board applied perpendicular to framing with strap blocking behind the horizontal joint and with solid blocking between the first two end studs	7	7	585
			4	4	850

For SI: 1 inch -25.4 mm, 1 pound per foot = 14.5939

a. Nominal shear values shall be multiplied by the resistance factor ϕ to determine design strength or divided by the safety factor Ω to determine allowable shear values as set forth in 780 CMR 2211.2.1.

b. Walls resisting seismic loads shall be subject to the limitations in 780CMR 1615.0.

TABLE 2211.2(3) NOMINAL SHEAR VALUES FOR SEISMIC FORCES IN POUNDS PER FOOT FOR SHEAR WALLS FRAMED WITH COLD-FORMED STEEL STUDS[a]

ASSEMBLY DESCRIPTION	MAXIMUM HEIGHT/LENGTH RATIO *h/w*	FASTENER SPACING AT PANEL EDGES[b] (inches)				MAXIMUM FRAMING SPACING (inches o.c.)
		6	4	3	2	
$^{15}/_{32}$-inch structural 1 sheathing (4-ply) (plywood) one side.	2:1[c]	780	990	1,465	1,625	24
$^{15}/_{32}$-inch Structural 1 sheathing (4-ply) plywood one side: end studs 0.043 inch minimum thickness	2:1	-	-	1.775	2.190	24
$^{15}/_{32}$-inch Structural 1 sheathing (4-ply) plywood one side: all studs and track 0.043 inch minimum thickness	2.1	890	1.330	1.775	2.190	24
$^{7}/_{16}$-inch OSB one side	2:1[c]	700	915	1.275	1.625	24
$^{7}/_{16}$-inch OSB one side end studs, 0.043 inch minimum thickness	2:1	-	-	1.520	2.060	24
0.018-inch minimum thickness steel sheet, one side	2:1	390	.	.	.	24
0.027-inch minimum thickness steel sheet, one side	2:1[c]	.	1.000	1.085	1.170	24

For SI: 1 inch -25.4 mm, 1 pound per foot = 14.5939N/m.

a. Nominal shear values shall be multiplied by the resistance factor ϕ to determine design strength or divided by the safety factor Ω to determine allowable shear values as set forth in 780 CMR 2211.2.1.

b. Screws shall be attached to intermediate supports at 12 inches on center unless otherwise shown.

c. In Seismic Design Category A, B and C the aspic ratio (*h/w*) is permitted to be 4:1 where the design shear is reduced as required by 780 CMR 2211.2.2, item 5.

2211.3 Type II Shear Walls. Type II (Perforated) shear walls sheathed with wood structural panels or sheet steel are permitted to resist wind and seismic loads when designed in accordance with this section. Type II walls shall meet the requirements for Type I walls except as revised by 780 CMR 2211.3.

2211.3.1 Limitations. The following limitations shall apply to the use of Type II shear walls:

1. A Type II shear wall segment, meeting the minimum aspect ratio (*h/w*) of 780 CMR 2211.3.2, Item 3, shall be located at each end of a Type II shear wall. Openings shall be permitted to occur beyond the ends of the Type II shear wall; however, the width of such openings shall not be included in the width of the perforated shear wall.
2. The nominal shear values shall be based upon edge screw spacing not less than four inches o.c.
3. A Type II shear wall shall not have out-of-plane (horizontal) offsets. Where out-of-plane offsets occur, portions of the wall on each side of the offset shall be considered as separate perforated shear walls.
4. Collectors for shear transfer shall be provided through the full length of the Type II shear wall.
5. A Type II shear wall shall have uniform top of wall and bottom of wall elevations. Type II shear walls not having uniform elevations shall

be designed by other methods.

6. Type II shear wall height, *h*, shall not exceed 20 feet (6096 mm).

2211.3.2 Type II Shear Wall Resistance. The Type II shear wall resistance shall be equal to the adjusted shear resistance multiplied by the sum of the widths (ΣL_i) of the perforated shear wall segments and shall be calculated in accordance with the following:

1. Percent full-height sheathing. The percent of full-height sheathing shall be calculated as the sum of widths (ΣL_i) of Type II shear wall segments divided by the total width of the Type II shear wall including openings.
2. Maximum opening height ratio. The maximum opening height ratio shall be calculated by dividing the maximum opening clear height by the shear wall height, *h*.
3. Unadjusted shear resistance. The unadjusted shear resistance shall be the design shear values calculated in accordance with Section 2211.2.1 based upon the values in Tables 2211.2(1) and 2211.2(3). The aspect ratio of all Type II shear wall segments used in calculations shall not exceed 2:1.

   Exception. Where permitted by Tables 2211.2.1(1) and 2211.2(3), the aspect ratio (*h/w*) of Type II wall segments greater than 2:1, but in no case greater than 4:1, is permitted to be included in the calculation of the unadjusted shear resistance for the wall, provided the values are multiplied by 2*w/h*.

4. Adjusted shear resistance. The adjusted shear resistance shall be calculated by multiplying the unadjusted shear resistance by the shear resistance adjustment factors of Table 2211.3. For intermediate percentages of full-height sheathing, the values are permitted to be determined by interpolation.

2211.3.3 Anchorage and Load Path. Design of perforated shear wall anchorage and load path shall conform to the requirements of this section, or shall be calculated using principles of mechanics.

2211.3.3.1 Anchorage for In-plane Shear. The unit shear force, *v*, transmitted into the top and out of the base of the Type II shear wall full-height sheathing segments, and into collectors (drag struts) connecting shear wall segments, shall be calculated in accordance with the following:

EQUATION 22-1

$$v = V/C_o\Sigma L_i$$

where:

v = Unit shear force, plf (kN/m).

V = Shear force in Type II shear wall, lbs (kN).

C_o = Shear resistance adjustment factor from Table 2211.3.

ΣL_i = Sum of widths of Type II shear wall segments, feet (mm/1,000).

2211.3.3.2 Uplift Anchorage at Type II Shear Wall Ends. Anchorage for uplift forces due to overturning shall be provided at each end of the Type II shear wall. Where seismic loads govern, the uplift anchorage shall be determined in accordance with the requirements of 780 CMR 2211.4.3.

2211.3.3.3 Uplift Anchorage Between Perforated Shear Wall Ends. In addition to the requirements of 780 CMR 2211.3.3.1, perforated shear wall bottom plates at full-height sheathing shall be anchored for a uniform uplift force, *t*, equal to the unit shear force, *v*, determined in 780 CMR 2211.3.3.1.

2211.3.3.4 Compression Chords. Vertical elements at each end of each perforated shear wall segment shall be designed for a compression force, *C*, from each story calculated in accordance with the following:

EQUATION 22-2

$$C = Vh/C_o\Sigma L_i$$

where:

C = Compression chord uplift force, lbs (kN).

V = Shear force in Type II shear wall, lbs (kN).

h = Shear wall height feet, (mm/1,000).

C_o = Shear resistance adjustment factor from Table 2211.3.

ΣL_i = Sum of widths of Type II shear wall segments, feet (mm/1,000).

2211.3.3.5 Load Path. A load path to the foundation shall be provided for the uplift shear and compression forces as determined from 780 CMR 2211.3.3.1 through 2211.3.3.4, inclusive. Elements resisting shear wall forces contributed by multiple stories shall be designed for the sum of forces contributed by each story.

TABLE 2211.3 SHEAR RESISTANCE ADJUSTMENT FACTOR - C_0

WALL HEIGHT (*h*)	MAXIMUM OPENING HEIGHT RATIO[a] AND HEIGHT				
	h/3	h/2	2h/3	5h/6	h
8'0"	2'8"	4'0"	5'4"	6'8"	8'0"
10'0"	3'4"	5'0"	6'8"	8'4"	10'0"
Percent full-height sheathing[b]	Shear Resistance Adjustment Factor				
10%	1.00	0.69	0.53	0.43	0.36
20%	1.00	0.71	0.56	0.45	0.38
30%	1.00	0.74	0.59	0.49	0.42
40%	1.00	0.77	0.63	0.53	0.45
50%	1.00	0.80	0.67	0.57	0.50
60%	1.00	0.83	0.71	0.63	0.56
70%	1.00	0.87	0.77	0.69	0.63
80%	1.00	0.91	0.83	0.77	0.71
90%	1.00	0.95	0.91	0.87	0.83
100%	1.00	1.00	1.00	1.00	1.00

a. See 780 CMR 2211.3.2, item 2.

b. See 780 CMR 2211.3.2, item 1.

2211.4 Additional Seismic Design Provisions.

2211.4.1 General. In addition to the requirements of 780 CMR 2211.2 and 2211.3, light-framed cold-formed steel wall systems, that resist seismic loads, shall comply with the requirements of this section.

2211.4.2 Connections. Connections for diagonal bracing members, top chord splices, boundary members and collectors shall be designed to develop the lesser of the nominal tensile strength of the member or the design seismic force multiplied by the seismic overstrength factor, Ω_o, from 780 CMR 1615.0. The pull-out resistance of screws shall not be used to resist design seismic forces.

2211.4.3 Anchorage of Braced Wall Segments. Studs or other vertical boundary members at the ends of wall segments, that resist seismic loads, braced with either sheathing or diagonal braces, shall be anchored such that the bottom track is not required to resist uplift by bending of the track web. Both flanges of the studs shall be braced to prevent lateral torsional buckling. Studs or other vertical boundary members and anchorage thereto shall have the nominal strength to resist design seismic force multiplied by the seismic overstrength factor, Ω_o, from 780 CMR 1615.0.

2211.4.4 Sheet Steel Sheathing. Where steel sheathing provides lateral resistance, the design and construction of such walls shall be in accordance with the additional requirements of this section. Perimeter members at openings shall be provided and shall be detailed to distribute the shearing stresses. Wall studs and track shall have a minimum uncoated base metal thickness of 33 mils (0.84 mm) and shall not have an uncoated base metal thickness greater than 48 mils (1.10 mm). The nominal shear value for light-framed wall systems shall be based upon values from Table 2211.2(3).

2211.4.5 Wood Structural Panel Sheathing. Where wood structural panels provide lateral resistance, the design and construction of such walls shall be in accordance with the additional requirements of this section. Perimeter members at openings shall be provided and shall be detailed to distribute the shearing stresses. Wood sheathing shall not be used to splice these members. Wall studs and track shall have a minimum uncoated base metal thickness of 33 mils (0.84 mm) and shall not have an uncoated base metal thickness greater than 48 mils (1.10 mm). The nominal shear value for light-framed wall systems shall be based upon values from Table 2211.2(3).

2211.4.6 Diagonal Bracing. Where diagonal bracing is provided for lateral resistance, provisions shall be made for pretensioning or other methods of installing tension-only bracing shall be used to guard against loose diagonal straps. The *l/r* of the brace is permitted to exceed 200.

780 CMR 2212.0 CAST-STEEL CONSTRUCTION

2212.1 Materials. Steel casting for building construction shall be cast from steel conforming to AISC 335 or AISC LRFD. All castings shall be free from injurious blow holes or other defects which will impair the structural strength.

WOOD

780 CMR 23.00 is Unique to Massachusetts

780 CMR 2301.0 GENERAL

2301.1 Scope. The provisions of 780 CMR 23.00 shall govern the materials, design, construction, and quality of wood members, systems, and structures, and their fasteners.

2301.2 General Requirements. Except as otherwise provided in 780 CMR 23.00, the design and construction of wood components, systems, and structures shall be in accordance with the following listed standards for allowable stress design (ASD) or the following listed standards:

1. ANSI/AF&PA NDS
2. AF&PA SDPWS Panel Supplement

780 CMR 2302.0 DEFINITIONS

2302.1 General. The following definitions shall apply to the provisions of 780 CMR 23.00.

ACCREDITATION BODY. An approved, third-party organization that is independent of the grading and inspection agencies and the lumber mills, and that initially accredits and subsequently monitors, on a continuing basis, the competency and performance of a grading or inspection agency related to carrying out specific tasks.

BOUNDARY ELEMENT. Diaphragms and shear wall boundary members to which sheathing transfers forces. Boundary elements include chords and drag struts at diaphragm and shear wall perimeters, interior openings, discontinuities and re-entrant corners.

COLLECTOR. A horizontal diaphragm element parallel and in line with the applied force that collects and transfers diaphragm shear forces to the vertical elements of the lateral-force-resisting system and/or distributes forces within the diaphragm.

CONVENTIONAL LIGHT-FRAME WOOD CONSTRUCTION. A type of construction whose primary structural elements are formed by a system of repetitive wood-framing members.

CRIPPLE WALL. A framed stud wall extending from the top of the foundation to the underside of floor framing for the lowest occupied floor level.

DIAPHRAGM. A horizontal or nearly horizontal system acting to transmit lateral forces to the vertical-resisting elements. When the term "diaphragm" is used, it includes horizontal bracing systems.

DIAPHRAGM, BLOCKED. A diaphragm in which adjacent sheathing edges not occurring over framing are supported on and fastened to common blocking members.

DIAPHRAGM, BOUNDARY. A location where shear is transferred into or out of the diaphragm sheathing. Transfer is either to a boundary element or to another force-resisting element.

DIAPHRAGM, CHORD. A diaphragm boundary element perpendicular to the applied load that is assumed to take axial stresses due to the diaphragm moment.

DIAPHRAGM, UNBLOCKED. A diaphragm that has edge nailing at supporting members only. Blocking between supporting structural members at panel edges is not included. Diaphragm panels are field nailed to supporting members.

DRAG STRUT. See "Collector."

FIBERBOARD. A fibrous, homogeneous panel made from lignocellulosic fibers (usually wood or cane) and having a density of less than 31 pounds per cubic foot (497 kg/m^3) but more than ten pounds per cubic foot (160 kg/m^3).

GLUED BUILT-UP MEMBER. A structural element, the section of which is composed of built-up lumber, wood structural panels or wood structural panels in combination with lumber, all parts bonded together with structural adhesives.

GRADE (LUMBER). The classification of lumber in regard to strength and utility in accordance with DOC PS 20 and the grading rules of an approved lumber rules writing agency.

HARDBOARD. A fibrous-felted, homogeneous panel made from lignocellulosic fibers consolidated under heat and pressure in a hot press to a density not less than 31 pounds per cubic foot (497 kg/m^3).

NAILING, BOUNDARY. A special nailing pattern required by design at the boundaries of diaphragms.

NAILING, EDGE. A special nailing pattern required by design at the edges of each panel within the assembly of a diaphragm or shear wall.

NAILING, FIELD. Nailing required between the sheathing panels and framing members at locations other than boundary nailing and edge nailing.

NATIVE LUMBER. Native lumber is wood processed in the Commonwealth of Massachusetts by a mill registered in accordance with 780 CMR 110.R4. Such wood may be ungraded but is stamped or certified in accordance with the requirements of 780 CMR110.R4.

NATURALLY DURABLE WOOD. The heartwood of the following species with the exception that an occasional piece with corner sapwood is permitted if 90% or more of the width of each side on which it occurs is heartwood.

Decay Resistant. Redwood, cedar, black locust and black walnut.

Termite Resistant. Redwood and Eastern red cedar.

NOMINAL SIZE (LUMBER). The commercial size designation of width and depth, in standard sawn lumber and glued laminated lumber grades; somewhat larger than the standard net size of dressed lumber, in accordance with DOC PS 20 for sawn lumber and in accordance with the NDS for glued laminated lumber.

PARTICLEBOARD. A generic term for a panel primarily composed of cellulosic materials (usually wood), generally in the form of discrete pieces or particles, as distinguished from fibers. The cellulosic material is combined with synthetic resin or other suitable bonding system by a process in which the interparticle bond is created by the bonding system under heat and pressure.

PERFORATED SHEAR WALL. A section of shear wall with full-height sheathing that meets the height-to-width ratio limits of 780 CMR 2305.3.3.

PERFORATED SHEAR WALL SEGMENT. A section of shear wall with full-height sheathing that meets the aspect ratio limits of 780 CMR 2305.3.3.

PRESERVATIVE-TREATED WOOD. Wood (including plywood) pressure-treated with preservatives in accordance with 780 CMR 2303.1.8.

SHEAR WALL. A wall designed to resist lateral forces parallel to the plane of a wall.

STRUCTURAL GLUED LAMINATED TIMBER. Any member comprising an assembly of laminations of lumber in which the grain of all laminations is approximately parallel longitudinally, in which the laminations are bonded with adhesives.

SUBDIAPHRAGM. A portion of a larger wood diaphragm designed to anchor and transfer local forces to primary diaphragm struts and the main diaphragm.

TIE-DOWN (HOLD-DOWN). A device used to resist uplift of the chords of shear walls.

TREATED WOOD. Wood impregnated under pressure with compounds that reduce their susceptibility to flame spread or to deterioration caused by fungi, insects, or marine borers.

WOOD SHEAR PANEL. A wood floor, roof, or wall component sheathed to act as a shear wall or diaphragm.

WOOD STRUCTURAL PANEL. A panel manufactured from veneers; or wood strands or wafers; or a combination of veneer and wood strands or wafers; bonded together with waterproof synthetic resins or other suitable bonding systems. Examples of wood structural panels are:

Composite Panels. A structural panel that is made of layers of veneer and wood-based material;

Oriented Strand Board (OSB). A wood structural panel that is a mat-formed product composed of thin rectangular wood strands or wafers arranged in oriented layers; and

Plywood. A wood structural panel comprised of plies of wood veneer arranged in cross-aligned layers.

780 CMR 2303.0 SUPPLEMENTAL REQUIREMENTS

2303.1 General. 780 CMR 2303.0 supplements the requirements in the referenced standards of 780 CMR 2301.2.

2303.2 Lumber.

2303.2.1 Standard. Lumber and lumber grading shall comply with DOC PS 20

2303.2.2 Alternate Grading. In lieu of a grade mark on lumber as required by DOC PS 20, a certificate of inspection as to species and grade issued by a lumber grading or inspection agency meeting the requirements of DOC PS 20 may be accepted for precut, remanufactured, or rough-sawn lumber, and for sizes larger than three inches (76 mm) nominal thickness.

2303.2.3 Native Lumber. Native lumber shall be acceptable for use in one and two story dwellings, barns, sheds, agricultural and accessory structures. Native lumber shall also be acceptable for use in other one and two story structures as columns when the design loads are 25% greater than required in 780 CMR 16.00; as joists, principal beams, and girders in floor constructions when the design loads are 15% greater than required in 780 CMR 16.00; and as other elements when the design loads are as required in 780 CMR 16.00.

Each piece of native lumber produced shall be stamped with the name and registration number of the producer in accordance with 780 CMR 110.R4. In addition, all native lumber shall bear an approved mark identifying the species of wood. In lieu of the stamp bearing the name and registration number and species identification, a certification bearing the same information may be provided by the producer for precut or re-manufactured lumber in accordance with 780 CMR 110.R4. When native lumber is used, it shall be subject to the following requirements:

1. Sizing Criteria. For lumber, sized in accordance with the DOC PS-20, figures for maximum fiber stress and modulus of elasticity for framing grade No. 2 shall be used in establishing span and spacing characteristics for all structural members.

2. Stress criteria: Lumber which is sized in excess of the dimensions established by the DOC PS-20 for the given nominal size referenced shall be allowed to have a maximum fiber stress increase above that provided in 780 CMR 2303.2.3, Item 1 in proportion to the increased bearing capacity of the cross section as provided in Table 2303.2 or as calculated.

TABLE 2302.3 NATIVE LUMBER - ALLOWABLE STRESSES

Nominal Size	Actual Lumber Size Closest size which does not exceed the size shown)	Multiplier factor based on lumber width	Factor to be added to multiplier factor for lumber oversized in thickness	
	Actual Size (thickness x width)		Thickness increase of ¼" to ½"	Thickness increase of over ½" to 1"
3 x 8	$2^{\frac{1}{2}}$ x $7^{\frac{1}{2}}$ $2^{\frac{1}{2}}$ x $7^{\frac{3}{4}}$ $2^{\frac{1}{2}}$ x 8	1.0 x Fs 1.07 1.14	+0.10	+0.20
3 x 10	$2^{\frac{1}{2}}$ x $9^{\frac{1}{2}}$ $2^{\frac{1}{2}}$ x $9^{1\frac{3}{4}}$ $2^{\frac{1}{2}}$ x 10	1.0 1.05 1.11	+0.10	+0.20
3 x 12	$2^{\frac{1}{2}}$ x $11^{\frac{1}{2}}$ $2^{\frac{1}{2}}$ x $11^{1\frac{3}{4}}$ $2^{\frac{1}{2}}$ x 12	1.0 1.04 1.09	+0.10	+0.20
3 x 14	$2^{\frac{1}{2}}$ x $13^{\frac{1}{2}}$ $2^{\frac{1}{2}}$ x $13^{1\frac{3}{4}}$ $2^{\frac{1}{2}}$ x 14	1.0 1.04 1.07	+0.10	+0.20
4 x 10	$3^{\frac{1}{2}}$ x $9^{\frac{1}{2}}$ $3^{\frac{1}{2}}$ x $9^{\frac{3}{4}}$ $3^{\frac{1}{2}}$ x 10	1.0 1.05 1.11	+0.07	+0.14
4 x 12	$3^{\frac{1}{2}}$ x $11^{\frac{1}{2}}$ $3^{\frac{1}{2}}$ x $11^{\frac{3}{4}}$ $3^{\frac{1}{2}}$ x 12	1.0 1.04 1.09	+0.07	+0.14
4 x 14	$3^{\frac{1}{2}}$ x $13^{\frac{1}{2}}$ $3^{\frac{1}{2}}$ x $13^{\frac{3}{4}}$ $3^{\frac{1}{2}}$ x 14	1.0 1.04 1.08	+0.07	+0.14

2303.3 Prefabricated Wood I-joists. Prefabricated wood I-joists shall conform to ASTM D 5055.

2303.4 Structural Glued Laminated Timber. Glued laminated timbers shall be manufactured and identified as required in AITC A190.1, and ASTM D3737.

2303.5 Wood Structural Panels

2303.5.1 Wood structural panels, when used structurally (including those used for siding, roof and wall sheathing, subflooring, diaphragms, and built-up members), shall conform to the requirements for its type in DOC PS 1 or DOC PS 2. Each panel or member shall be identified for grade and glue type by the trademarks of an approved testing and grading agency. Wood structural panel components shall be identified by the trademarks of an approved testing and inspection agency indicating conformance with the applicable standard.

2303.5.2 Wood structural panels when permanently exposed in outdoor applications shall be of exterior type, except that wood structural panel roof sheathing exposed to the outdoors on the underside may be interior type bonded with exterior glue, Exposure 1.

2303.5.3 In NDS, Section 9.2.1.1, the phrase "an approved source" shall be taken to mean "AF&PA ASD Panel Supplement."

2303.5.4 In ASCE 16-95, Section 8.3.1 substitute the following for the first paragraph: "Panel stiffness and factored reference resistance shall be used in structural - use panel design and shall be in accordance with AF&PA LRFD Panel Supplement - 1996, or shall be determined by test in accordance with DOC PS 1 or DOC PS 2."

2303.6 Fiberboard. Fiberboard for its various uses shall conform to ANSI/AHA A194.1 or ASTM C 208. Fiberboard sheathing, when used structurally, shall be so identified by an approved agency as conforming to ANSI/AHA A194.1 or ASTM C 208.

2303.6.1 Jointing. To ensure tight fitting assemblies, edges shall be manufactured with square, ship-lapped, beveled, tongue-and-groove, or U-shaped joints.

2303.1.5.2 Exposure to Weather. Fiberboard shall not be used for an structural application, such as floor or roof deck or wall sheathing, where it will be exposed to the weather.

2303.7 Hardboard. Hardboard siding used structurally shall be identified by an approved agency conforming to AHA A135.6. Hardboard underlayment shall meet the strength requirements of $^{7}/_{32}$-inch (5.6 mm) or ¼-inch (6.4 mm) service class hardboard planed or sanded on one side to a uniform thickness of not less than 0.200 inch (5.1 mm). Prefinished hardboard paneling shall meet the requirements of AHA A135.5. Other basic hardboard products shall meet the requirements of AHA A135.4. Hardboard products shall be installed in accordance with manufacturer's recommendations, and shall not be exposed to the weather.

2303.8 Particleboard. Particleboard shall conform to ANSI A208.1. Particleboard shall be identified by the grade mark or certificate of inspection issued by an approved agency. Particleboard shall not be utilized for applications other than indicated in 780 CMR 2303.8.

2303.8.1 Floor Underlayment. Particleboard floor underlayment shall conform to Type PBU of ANSI A208.1. Type PBU underlayment shall not be less than ¼-inch (6.4 mm) thick and shall be installed in accordance with the installation instructions of the Composite Panel Association.

2303.9 Preservative-treated Wood. Lumber, timber, plywood, piles and poles supporting permanent structures required by 780 CMR 2304.6 to be preservative-treated shall conform to the requirements of the applicable AWPA Standard C1, C2, C3, C4, C9, C14, C15, C16, C22, C23, C24, C28, C31, C33 and M4, for the species, product, preservative and end use. Preservatives shall conform to AWPA P1/P13, P2, P5, P8 and P9.

2303.9.1 Identification. Wood that is preservative-treated shall bear the quality mark of an inspection agency that maintains continuing supervision, testing and inspection over the quality of the preservative-treated wood. Inspection agencies for preservative treated wood shall be listed by an accreditation body that complies with the requirements of the American Lumber Standards Treated Wood Program, or equivalent. The quality mark shall be on a stamp or label affixed to the preservative-treated wood. The quality mark shall include the following information:

1. Identification of treating manufacturer.
2. Type of preservative used.
3. Minimum preservative retention (pef).
4. End use for which the product is treated.
5. AWPA standard to which the product was treated.
6. Identity of the accredited inspection agency.

2303.9.2 Moisture Content. Where preservative-treated wood is used in enclosed locations where drying in service cannot readily occur, such wood shall be at a moisture content of 19% or less for lumber and 15% or less for wood structural panels before being covered with insulation, interior wall finish, floor covering or other materials.

2303.10 Fire-retardant-treated Wood. Fire-retardant-treated wood is any wood product which, when impregnated with chemical by a pressure process or other means during manufacture, shall have, when tested in accordance with ASTM E 84, a listed flame spread index of 25 or less and show no evidence of significant progressive combustion when the test is continued for an additional 20-minute period. In addition, the flame front shall not progress more than 10.5 feet (3200 mm) beyond the centerline of the burners at any time during the test.

2303.10.1 Labeling. Fire-retardant-treated lumber and wood structural panels shall be labeled. The label shall contain the following items:

1. The identification mark of an approved agency
2. Identification of the treating manufacturer.
3. The name of the fire-retardant treatment.
4. The species of wood treated.
5. Flame spread and smoke-developed index.
6. Method of drying after treatment.
7. Conformance with appropriate standards in accordance with 780 CMR 2303.10.2 through 2303.10.5.
8. For fire-retardant-treated wood exposed to weather, damp or wet locations, include the words "No increase in the listed classification when subjected to the Standard Rain Test" (ASTM D 2898).

2303.10.2 Strength Adjustments. Design values for untreated lumber and wood structural panels shall be adjusted for fire-retardant-treated wood. Adjustments to design values shall be based on a method of investigation that takes into consideration the effects of the anticipated temperature and humidity to which the fire-retardant-treated wood will be subjected, the type of treatment and re-drying procedures.

2303.10.2.1 Wood Structural Panels. The effect of treatment and the method of redrying after treatment, and exposure to high temperatures and high humidities on the flexure properties of fire-retardant-treated softwood plywood shall be determined in accordance with ASTM D 5516. The test data developed by ASTM D 5516 shall be used to develop adjustment factors, maximum loads and spans, or both, for untreated plywood design values in accordance with ASTM D 6305. Each manufacturer shall publish the allowable maximum loads and spans for service as floor and roof sheathing for its treatment.

2303.10.2.2 Lumber. For each species of wood treated, the effect of the treatment and the method of redrying after treatment and exposure to high temperatures and high humidities on the allowable design properties of fire-retardant-treated lumber shall be determined in accordance with ASTM D 5664. The test data developed by ASTM D 5664 shall be used to develop modification factors for use at or near room temperature and at elevated temperatures and humidity in accordance with an approved method of investigation. Each manufacturer shall publish the modification factors for service at temperatures of not less than 80°F (26.7°C) and for roof framing. The roof framing modification factors shall take into consideration the climatological location.

2303.10.3 Exposure to Weather, Damp or Wet Locations. Where fire-retardant-treated wood is exposed to weather, or damp or wet locations, it shall be identified as "Exterior" to indicate there is no increase in the listed flame spread index as defined in 780 CMR 2303.10 when subjected to ASTM D 2898.

2303.10.4 Interior Applications. Interior fire-retardant-treated wood shall have moisture content of not over 28% when tested in accordance with ASTM D 3201 procedures at 92% humidity. Interior fire-retardant-treated wood shall be tested in accordance with 780 CMR 2303.10.2.1 or 2303.10.2.2. Interior fire-retardant-treated wood designated as Type A shall be tested in accordance with the provisions of 780 CMR 2303.10.

2303.10.5 Moisture Content. Fire-retardant-treated wood shall be dried to a moisture content of 19% or less for lumber and 15% or less for wood structural panels before use. For wood kiln dried after treatment (KDAT), the kiln temperatures shall not exceed those used in kiln drying the lumber and plywood submitted for the tests described in 780 CMR 2303.10.2.1 for plywood and 780 CMR 2303.10.2.2 for lumber.

2303.10.6 Type I and II Construction Applications. See780 CMR 603.1 for limitations on the use of fire-retardant-treated wood in buildings of Type I or II construction.

2303.11 Hardwood Plywood. Hardwood and decorative plywood shall be manufactured and identified as required in HPVA HP-1.

2303.12 Trusses. Metal plate connected wood trusses shall be manufactured as required by TPI 1. Each manufacturer of trusses using metal plate connectors shall retain an approved agency to make nonscheduled inspections of truss manufacturing and delivery operations. The inspection shall cover all phases of truss operations, including lumber storage, handling, cutting fixtures, presses and rollers, manufacturing, bundling, and banding.

2303.12.1 Truss Design and Erection Documents. Truss design and erection documents shall be prepared by a registered design professional experienced in structural engineering. A copy of the final truss design and erection documents shall be provided to the Building Official. Truss design and erection documents shall be provided with the shipments of trusses delivered to the job site. Truss design and erection documents shall include, at a minimum, the information specified in 780 CMR 2303.12.1, items 1. through 13.

1. Slopes, depths, spans, and spacings;
2. Locations and details of joints and field splices;
3. Required bearing widths for each load combination;
4. Design loads (uniformly distributed, concentrated, and moments), including, but not limited to, dead loads, live loads, snow loads (basic, drifting, and sliding), wind loads (external and internal pressures and suctions), seismic loads, impact loads, and hanging loads, individually for top chords, bottom chords, and web members for each load combination;
5. Adjustments to lumber and metal connector plate design values for conditions of use;
6. Reaction forces and directions at each support for each load combination;
7. Metal connector plate types, sizes, thicknesses or gauges, and the dimensioned locations of each metal connector plate;
8. Lumber size, species, and grade for each member;
9. Connection requirements and details for:
    15.1. Truss-to-support (truss girders, beams, walls, etc.); and
    15.2. Truss ply-to-ply.
10. Calculated deflection ratios and/or maximum deflection values for each load case and load combination;
11. Stresses (bending and/or axial) in each truss member for each load combination. Note members where stress reversals occur.

12. Required truss member bracing to account for member slenderness effects. Detail the types (continuous, "T", "L", etc.), sizes, locations, connections, and end terminations for continuous bracing. Truss member bracing requirements to account for member slenderness effects shall be indicated on the truss erection drawings and the truss design drawings.
13. Required truss member reinforcing and/or bracing for out-of-plane wind loading.

2303.13 Joist Hangers and Similar Metal Connectors. The vertical load-bearing capacity, torsional moment capacity, and deflection characteristics of joist hangers and similar connectors shall be determined in accordance with ASTM D 1761, using lumber having a specific gravity of 0.49 or greater, but not greater than 0.55.

2303.13.1 Vertical Load Capacity for Joist Hangers. The vertical load capacity for the joist hanger shall be determined by testing three joist hanger assemblies as specified in ASTM D 1761. If the ultimate vertical load for any one of the tests varies more than 20% from the average ultimate vertical load, at least three additional tests shall be conducted. The allowable vertical load for a normal duration of loading of the joist hanger shall be the lowest value determined from the following:

1. The lowest ultimate vertical load from any test divided by three (where three tests are conducted and each ultimate vertical load does not vary more than 20% from the average ultimate vertical load).
2. The average ultimate vertical load for all tests divided by six (where six or more tests are conducted).
3. The vertical load at which the vertical movement of the joist with respect to the header is 0.125 inch (3.2 mm) in any test.
4. The allowable design load for nails or other fasteners utilized to secure the joist hanger to the wood members.
5. The allowable design load for the wood members forming the connection.

2303.13.2 Torsional Moment Capacity for Joist Hangers. The torsional moment capacity for the joist hanger shall be determined by testing at least three joist hanger assemblies as specified in ASTM D 1761. The allowable torsional moment for normal duration of loading of the joist hanger shall be the average torsional moment at which the lateral movement of the top or bottom of the joist with respect to the original position of the joist is 0.125 inch (3.2 mm).

2303.13.3 Design Value Modifications for Joist Hangers. For species of wood other than that used in the tests, the allowable design values for joist hangers shall be adjusted for specific gravity where failure is controlled by dowel type fasteners (such as nails or bolts), and shall be adjusted for the bearing strength of the wood where failure is controlled by bearing on the wood. Allowable design values for joist hangers that are determined by 780 CMR 2303.13.1, Item 4. or 5. shall be permitted to be modified by the appropriate duration of loading factors as specified in AFPA NDS. Allowable design values determined by 780 CMR 2303.13.1, Item 1., 2. or 3. shall not be modified by duration of loading factors.

2303.14 Nails and Staples. Nails and staples shall conform to requirements of ASTM F 1667. Nails used for framing and sheathing connections shall have minimum average bending yield strengths as follows: 80 ksi (551 MPa) for shank diameters larger than 0.177 inch (4.50 mm), but not larger than 0.254 inch (6.45 mm); 90 ksi (620 MPa) for shank diameters larger than 0.142 inch (3.61 mm), but not larger than 0.177 inch (4.50 mm); and 100 ksi (689 MPa) for shank diameters of 0.142 inch (3.61 mm) or less.

780 CMR 2304.0 GENERAL CONSTRUCTION REQUIREMENTS

2304.1 Framing Around Flues and Chimneys. Combustible framing shall be a minimum of two inches (51 mm), but shall not be less than the distance specified in 780 CMR 2111.0 and 2113.0 and the *International Mechanical Code*, from flues, chimneys and fireplaces, and six inches (152 mm) away from flue openings.

2304.2 Wall Sheathing.

2304.2.1 Wall Sheathing. Except as provided for in 780 CMR 1405.0 for weather boarding or where stucco construction that complies with 780 CMR 2510.0 is installed, enclosed buildings shall be sheathed with one of the materials of the nominal thickness specified in Table 2304.2.

2304.2.1.1 Wood Structural Panel Sheathing. Where wood structural panel sheathing is used as the exposed finish on the exterior of outside walls, it shall have an exterior exposure durability classification. Where wood structural panel sheathing is used on the exterior of outside walls but not as the exposed finish, it shall be of a type manufactured with exterior glue (Exposure 1 or Exterior). Where wood structural panel sheathing is used elsewhere, it shall be of a type manufactured with intermediate or exterior glue.

TABLE 2304.2 MINIMUM THICKNESS OF WALL SHEATHING

SHEATHING TYPE	MINIMUM THICKNESS	MAXIMUM WALL STUD SPACING
Wood boards	⅝ inch	24 inches on center
Fiberboard	½ inch	16 inches on center
Wood structural panel	In accordance with Tables 2308.9.3(2) and 2308.9.3(3)	—
M-S "Exterior Glue" and M-2 "Exterior Glue" Particleboard	In accordance with Tables 2306.4.3 and 2308.9.3(5)	—
Gypsum sheathing	½ inch	16 inches on center
Gypsum wallboard	½ inch	24 inches on center
Reinforced cement mortar	1 inch	24 inches on center

For SI: 1 inch - 25.4 mm

2304.2.2 Interior Paneling. Softwood wood structural panels used for interior paneling shall conform with the provisions of 780 CMR 8.00. Panels shall comply with DOC PS 1 or PS 2. Prefinished hardboard paneling shall meet the requirements of AHA A135.5. Hardwood plywood shall conform to HPVA HP-1.

2304.3 Structural Floor and Roof Sheathing. The maximum spans for floor and roof sheathing shall comply with Tables 2304.3(1), 2304.3(2), 2304.3(3), 2304.3(4) or 2304.3(5), as applicable. Wood structural panel roof sheathing shall be bonded by exterior glue.

TABLE 2304.3(1) ALLOWABLE SPANS FOR LUMBER FLOOR AND ROOF SHEATHING

SPAN (inches)	MINIMUM NET THICKNESS (inches) OF LUMBER PLACED			
	Perpendicular to supports		Diagonally to supports	
	Surfaced dry[a]	Surfaced unseasoned	Surfaced dry[c]	Surfaced unseasoned
Floors				
24	¾	25/32	¾	25/32
16	⅝	11/16	⅝	11/16
Roofs				
2	⅝	11/16	¾	25/32

For SI: 1 inch - 25.4 mm

a. Maximum 19% moisture content

TABLE 2304.3(2) SHEATHING LUMBER, MINIMUM GRADE REQUIREMENTS: BOARD GRADE

SOLID FLOOR OR ROOF SHEATHING	SPACED ROOF SHEATHING	GRADING RULES
Utility	Standard	NLGA, WCLIB, WWPA
4 common or utility	3 common or standard	NLGA, WCLIB, WWPA, NSLB or NELMA
No. 3	No. 2	SPIB
Merchantable	Construction common	RIS

TABLE 2304.3(3) ALLOWABLE SPANS AND LOADS FOR WOOD STRUCTURAL PANEL SHEATHING AND SINGLE-FLOOR GRADES CONTINUOUS OVER TWO OR MORE SPANS WITH STRENGTH AXIS PERPENDICULAR TO SUPPORTS[a, b]

SHEATHING GRADES		ROOF[c]				FLOOR[d]
Panel span rating roof/floor span	Panel thickness (inches)	Maximum span (inches)		Load[e] (psf)		Maximum span (inches)
		With edge support[f]	Without edge support	Total load	Live load	
12/0	5/16	12	12	40	30	0
16/0	5/16, ⅜	16	16	40	30	0
20/0	5/16, ⅜	20	20	40	30	0
24/0	⅜, 7/16, ½	24	20[g]	40	30	0
24/16	7/16, ½	24	24	50	40	16
32/16	15/32, ½, ⅝	32	28	40	30	16[h]
40/20	19/32, ⅝, ¾, ⅞	40	32	40	30	20[h,i]
48/24	23/32, ¾, ⅞	48	36	45	35	24
54/32	⅞, 1	54	40	45	35	32
60/32	⅞, 1⅛	60	48	45	35	32
SINGLE FLOOR GRADES		ROOF[c]				FLOOR[d]
Panel span rating	Panel thickness (inches)	Maximum span (inches)		Load[e] (psf)		Maximum span (inches)
		With edge support[f]	Without edge support	Total load	Live load	
16 o.c.	½, 19/32, ⅝	24	24	50	40	16[b]
20 o.c.	19/32, ⅝, ¾	32	32	40	30	20[h,i]
24 o.c.	23/32, ¾	48	36	35	25	24
32 o.c.	⅞, 1	48	40	50	40	32
48 o.c.	1 3/32, 1⅛	60	48	50	40	48

For SI: 1 inch = 25.4 mm, 1 pound per square foot = 0.0479 kN/m².

a. Applies to panels 24 inches or wider.

b. Reserved.

c. Uniform load deflection limitations 1/180 of span under live load plus dead load, 1/240 under live load only.

d. Panel edges shall have approved tongue-and-groove joints or shall be supported with blocking un less ¼-inch minimum thickness underlayment or 1½ inches of approved cellular or lightweight concrete is placed over the subfloor, or finish floor is ¾-inch wood strip. Allowable uniform load based on deflection of 1/360 of span is 100 pounds per square foot except the span rating of 48 inches on center is based on a total load of 65 pounds per square foot.

e. Allowable load at maximum span.

f. Tongue-and-groove edges, panel edge clips (one midway between each support, except two equally spaced between supports 48 inches on center), lumber blocking or other. Only lumber blocking shall satisfy blocked diaphragm requirements.

g. For 1/2-inch panel, maximum span shall be 24 inches.

h. Span is permitted to be 24 inches on center where ¾-inch wood strip flooring is installed at right angles to joist.

i. Span is permitted to be 24 inches on center for floors where 1½ inches of cellular or lightweight concrete is applied over the panels.

TABLE 2304.3(4) ALLOWABLE SPANS FOR WOOD STRUCTURAL PANEL COMBINATION SUBFLOOR-UNDERLAYMENT (SINGLE FLOOR)[a]

(Panels Continuous over Two or More Spans and Strength Axis Perpendicular to Supports)

IDENTIFICATION	MAXIMUM SPACING OF JOISTS (inches)				
	16	20	24	32	48
Species group[c]	Thickness (inches)				
1	½	⅝	¾	-	-
2, 3	⅝	¾	⅞	-	-
4	¾	⅞	1	-	-
Single floor span rating[d]	16 o.c.	20 o.c.	24 o.c.	32 o.c.	48 o.c.

For SI: 1 inch = 25.4 mm, 1 pound per square foot = 0.0479 kN/m².

a. Spans limited to value shown because of possible effects of concentrated loads. Allowable uniform loads based on deflection of 1/360 of span is 100 pounds per square foot except allowable total uniform load for 1⅛-inch wood structural panels over joists spaced 48 inches on center is 65 pounds per square foot. Panel edges shall have approved tongue-and-groove joints or shall be supported with blocking, unless ¼-inch minimum thickness underlayment or 1½ inches of approved cellular or lightweight concrete is placed over the subfloor, or finish floor is ¾-inch wood strip.

b. Reserved.

c. Applicable to all grades of sanded exterior-type plywood. See DOC PS 1 for plywood species groups.

d. Applicable to Underlayment grade, C-C (Plugged) plywood, and Single Floor grade wood structural panels.

TABLE 2304.3(5) ALLOWABLE LOAD (PSF) FOR WOOD STRUCTURAL PANEL ROOF SHEATHING CONTINUOUS OVER TWO OR MORE SPANS AND STRENGTH AXIS PARALLEL TO SUPPORTS

(Plywood Structural Panels Are Five-ply, Five-layer Unless Otherwise Noted)[b]

PANEL GRADE	THICKNESS (inch)	MAXIMUM SPAN (inches)	LOAD AT MAXIMUM SPAN (psf)	
			Live	Total
Structural I sheathing	$^{7}/_{16}$	24	20	30
	$^{15}/_{32}$	24	35[c]	45[c]
	½	24	40[c]	50[c]
	$^{19}/_{32}$, ⅝	24	70	80
	$^{23}/_{32}$, ¾	24	90	100
Sheathing, other grades covered in DOC PS 1 or DOC PS 2	$^{7}/_{16}$	16	40	50
	$^{15}/_{32}$	24	20	25
	$^{1}/_{2}$	24	25	30
	$^{19}/_{32}$	24	40[c]	50[c]
	⅝	24	45[c]	55[c]
	$^{23}/_{32}$, ¾	24	60[c]	65[c]

For SI: 1 inch = 25.4 mm, 1 pound per square foot = 0.0479 kN/m^2 .

a. Reserved.

b. Uniform load deflection limitations $^{1}/_{180}$ of span under live load plus dead load, $^{1}/_{240}$ under live load only. Edges shall be blocked with lumber or other approved type of edge supports.

c. For composite and four-ply plywood structural panel, load shall be reduced by 15 pounds per square foot.

2304.4 Mechanically Laminated Floors and Decks. A laminated lumber floor or deck built up of wood members set on edge, when meeting the following requirements, is permitted to be designed as a solid floor or roof deck of the same thickness, and continuous spans are permitted to be designed on the basis of the full cross section using the simple span moment coefficient.

Nail lengths shall not be less than two and one-half times the net thickness of each lamination. Where deck supports are four feet (1219 mm) on center or less, side nails shall be spaced not more than 30 inches (762 mm) on center alternately near top and bottom edges, and staggered one-third of the spacing in adjacent laminations. Where supports are spaced more than four feet (1219 mm) on center, side nails shall be spaced not more than 18 inches (457 mm) on center alternately near top and bottom edges, and staggered ⅓ of the spacing in adjacent laminations. Two side nails shall be used at each end of butt-jointed pieces.

Laminations shall be toe-nailed to supports with 20d or larger common nails. Where the supports are four feet (1219 mm) on center or less, alternate laminations shall be toe-nailed to alternate supports; where supports are spaced more than four feet (1219 mm) on center, alternate laminations shall be toe-nailed to every support. A single-span deck shall have all laminations full length. A continuous deck of two spans shall not have more than every fourth lamination spliced within quarter points adjoining supports. Joints shall be closely butted over supports or staggered across the deck but within the adjoining quarter spans. No lamination shall be spliced more than twice in any span.

2304.5 Connections and Fasteners.

2304.5.1 Nails. The number and size of nails connecting wood members shall not be less than that set forth in Table 2304.5.

2304.5.2 Sheathing Fasteners. Sheathing nails or similar fasteners shall be driven so that their head or crown is flush with the surface of the sheathing.

2304.5.3 Fasteners in Preservative-treated and Fire-retardant-treated Wood. Fasteners for preservative-treated and fire-retardant-treated wood shall be of hot-dipped zinc coated galvanized steel, stainless steel, silicon bronze, or copper.

2304.5.4 Columns and Posts. Wood columns and posts shall be framed to provide full end bearing. Alternatively, column-and-post end connections shall be designed to resist the full compressive loads. Column and post end connections shall be fastened to resist lateral and net induced uplift forces.

TABLE 2304.5 FASTENING SCHEDULE

CONNECTION	FASTENING^{a,m}	LOCATION
1. Joist to sill or girder	3 - 8d common 3 - 3" x 0.131" nails 3 - 3" 14 gage staples	toenail
2. Bridging to joist	2 - 8d common 2 - 3" x 0.131" nails 2 - 3"14 gage staples	toenail each end
3. 1" x 6" subfloor or less to each joist	2 - 8d common	face nail
4. Wider than 1" x 6" subfloor to each joist	3 - 8d common	face nail
5. 2" subfloor to joist or girder	2 - 16d common	blind and face nail
6. Sole plate to joist or blocking	16d at 16" o.c. 3" x 0.131" nails at 8" o.c. 3" 14 gage staples at 12" o.c.	typical face nail
Sole plate to joist or blocking at braced wall panel	3 - 16d at 16" 4 - 3" x 0.131" nails at 16" 4 - 3" 14 gage staples per 16"	braced wall panels
7. Top plate to stud	2 - 16d common 3 - 3" x 0.131" nails 3 - 3" 14 gage staples	end nail
8. Stud to sole plate	4 - 8d common 4 - 3" x 0.131" nails 3 - 3" 14 gage staples	toenail
	2 - 16d common 3 - 3" x 0.131" nails 3 - 3" 14 gage staples	end nail
9. Double studs	16d at 24" o.c. 3" x 0.131" nail at 8" o.c. 3" 14 gage staple at 8" o.c.	face nail
10. Double top plates Double top plates	16d at 16" o.c. 3" x 0.131" nail at 12" o.c. 3" 14 gage staple at 12" o.c.	typical face nail
	8-16d common 12 - 3" x 0.131" nails 12 - 3" 14 gage staples	lap splice
11. Blocking between joists or rafters to top plate	3 - 8d common 3 - 3" x 0.131" nails 3 - 3" 14 gage staples	toenail
12. Rim joist to top plate	8d at 6" o.c. 3" x 0.131" nail at 6" o.c. 3" 14 gage staple at 6" o.c.	toenail
13. Top plates, laps and intersections	2 - 16d common 3 - 3" x 0.131" nails 3 - 3" 14 gage staples	face nail
14. Continuous header, two pieces	16d common	16" o.c. along edge
15. Ceiling joists to plate	3 - 8d common 5 - 3" x 0.131" nails 5 - 3" 14 gage staples	toenail
16. Continuous header to stud	4 - 8d common	toenail
17. Ceiling joists, laps over partitions (see 780 CMR 2308.10.4.1, Table 2308.10.4.1)	3 - 16d common minimum, Table 2308.10.4.1 4 - 3" x 0.131" nails 4 - 3" 14 gage staples	face nail
18. Ceiling joists to parallel rafters (see 780 CMR 2308.10.4.1, Table 2308.10.4.1)	3 - 16d common minimum, Table 2308.10.4.1 4 - 3" x 0.131" nails 4 - 3" 14 gage staples	face nail
19. Rafter to plate (see 780 CMR 2308.10.1, Table 2308.10.1)	3 - 8d common 3 - 3" x 0.131" nails 3 - 3" 14 gage staples	toenail
20. 1" diagonal brace to each stud and plate	2 - 8d common 2 - 3"x 0.131"nails 2 - 3" 14 gage staples	face nail
21. 1" x 8" sheathing to each bearing	2 - 8d common	face nail
22. Wider than 1"x 8" sheathing to each bearing	3 - 8d common	face nail

TABLE 2304.5 - continued

CONNECTION	FASTENING[a,m]	LOCATION
23. Built-up corner studs	16d common 3" x 0.131" nails 3" 14 gage staples	24" o.c. 16" o.c. 16" o.c.
24. Built-up girder and beams	20d common 32" o.c 3" x 0.131" nail at 24" o.c. 3" 14 gage staple at 24" o.c.	face nail at top and bottom staggered on opposite sides
	2 - 20d common 3 - 3" x 0.13 1" nails 3 - 3" 14 gage staples	face nail at ends and at each splice
25. 2" planks	16d common	at each bearing
26. Collar tie to rafter	3 - 10d common 4 - 3"x 0.131"nails 4 - 3" 14 gage staples	face nail
27. Jack rafter to hip	3 - 10d common 4 - 3" x 0.13 1"nails 4 - 3" 14 gage staples	toenail
	2 - 16d common 3 - 3"x 0.131"nails 3 - 3" 14 gage staples	face nail
28. Roof rafter to 2-by ridge beam	2 - 16d common 3 - 3" x 0.131" nails 3 - 3" 14 gage staples 2 - 16d common 3 - 3"x 0.131"nails 3 - 3" 14 gage staples	toenail face nail
29. Joist to band joist	3 - 16d common 5 - 3"x 0.131"nails 5 - 3" 14 gage staples	face nail
30. Ledger strip	3 - 16d common 4 - 3^× 0.131" nails 4 - 3^ 14 gage staples	face nail
31. Wood structural panels and particleboard:[b] Subfloor, roof and wall sheathing (to framing):	½" and less 6d[c,l] 2⅜" × 0.113" nail[n] 1¾" 16 gage[o] 19/32" to ¾" 8d[d] or 6d[e] 2 ⅜^× 0.113" nail[p] 2" 16 gage[p] ⅝" to 1" 8d[c] 1⅛" to 1¼" 10d[d] or 8d[e]	
Single Floor (combination subfloor-underlayment to framing):	¾" and less 6d[e] ⅞" to 1" 8d[e] 1⅛" to 1¼" 10d[d] or 8d[e]	
32 Panel siding (to framing)	½" or less 6d[f] ⅝" 8d[f]	
33. Fiberboard sheathing:[g]	½" No. 11 gage roofing nail[h] 6d common nail No. 16 gage staple[i] 25/32" No. 11 gage roofing nail[h] 8d common nail No. 16 gage staple[i]	
34. Interior paneling	¼" ⅜"	4d[j] 6dk

For SI: 1 inch = 25.4 mm.

a. Common or box nails are permitted to be used except where otherwise stated.

b. Nails spaced at six inches on center at edges, 12 inches at intermediate supports except 6 inches at supports where spans are 48 inches or more. For nailing of wood structural panel and particleboard diaphragms and shear walls, refer to 780 CMR 2305.0. Nails for wall sheathing are permitted to be common, box or casing.

c. Common or deformed shank.

d. Common.

e. Deformed shank.

f. Corrosion-resistant siding or casing nail.

g. Fasteners spaced three inches on center at exterior edges and six inches on center at intermediate supports.

h. Corrosion-resistant roofing nails with 7/16-inch-diameter head and 1½-inch length for ½-inch sheathing and 1¾-inch length for 25/32-inch sheathing.

i. Corrosion-resistant staples with nominal 7/16-inch crown and 1⅛-inch length for ½-inch sheathing and 1½-inch length for 25/32-inch sheathing. Panel supports at 16 inches (20 inches if strength axis in the long direction of the panel, unless otherwise marked).

j. Casing or finish nails spaced six inches on panel edges, 12 inches at intermediate supports.

k. Panel supports at 24 inches. Casing or finish nails spaced six inches on panel edges, 12 inches at intermediate supports.

l. For roof sheathing applications, 8d nails are the minimum required for wood structural panels.

m. Staples shall have a minimum crown width of $^7/_{16}$ inch.

n. For roof sheathing applications, fasteners spaced four inches on center at edges, eight inches at intermediate supports.

o. Fasteners spaced four inches on center at edges, eight inches at intermediate supports for subfloor and wall sheathing and three inches on center at edges, six inches at intermediate supports for roof sheathing.

p. Fasteners spaced four inches on center at edges, eight inches at intermediate supports.

2304.6 Protection Against Decay and Termites.

2304.6.1 General. Where required by 780 CMR 2304.6, protection from decay and termites shall be provided by the use of naturally durable or preservative-treated wood.

2304.6.2 Wood Used above Ground. Wood installed above ground in the locations specified in 780 CMR 2304.6.2.1 through 2304.6.2.6 shall be naturally durable wood or preservative-treated wood that uses water-borne preservatives, and shall be treated in accordance with AWPA C2 or C9 or applicable AWPA standards for above-ground use.

2304.6.2.1 Joists, Girders, and Subflooring. Where wood joists or the bottom of a wood structural floor without joists are closer than 18 inches (457 mm), or wood girders are closer than 12 inches (305 mm), to the exposed ground in crawl spaces or unexcavated areas located within the perimeter of the building foundation, the floor assembly (including posts, girders, joists and subfloor) shall be of naturally durable or preservative-treated wood.

2304.6.2.2 Framing. Wood framing members, including wood sheathing, which rest on exterior foundation walls and are less than 8 inches (203 mm) from exposed earth shall be of naturally durable or preservative-treated wood. Wood framing members and furring strips attached directly to the interior of exterior masonry or concrete walls below grade shall be of approved naturally durable or preservative-treated wood.

2304.6.2.3 Sleepers and Sills. Sleepers and sills on a concrete or masonry slab that is in direct contact with earth shall be of naturally durable or preservative-treated wood.

2304.6.2.4 Girder Ends. The ends of wood girders entering exterior masonry or concrete walls shall be provided with a ½-inch (12.7 mm) air space on top, sides and end, unless naturally durable or preservative-treated wood is used.

2304.6.2.5 Wood Siding. Clearance between wood siding and earth on the exterior of a building shall not be less than six inches (152 mm) except where siding, sheathing and wall framing are of naturally durable or preservative-treated wood.

2304.6.2.6 Posts or Columns. Posts or columns supporting permanent structures and supported by a concrete or masonry slab or footing that is in direct contact with the earth shall be of naturally durable or preservative-treated wood.

Exceptions:

1. Posts or columns that are either exposed to the weather or located in basements or cellars, supported by concrete piers or metal pedestals projected at least one inch (25 mm) above the slab or deck and six inches (152 mm) above exposed earth, and are separated there from by an impervious moisture barrier.
2. Posts or columns in enclosed crawl spaces or unexcavated areas located within the periphery of the building, supported by a concrete pier or metal pedestal at a height greater than eight inches (203 mm) from exposed ground, and are separated there from by an impervious moisture barrier.

2304.6.3 Laminated Timbers. The portions of glued laminated timbers that form the structural supports of a building or other structure and are exposed to weather and not properly protected by a roof, eave or similar covering shall be pressure treated with preservative, or be manufactured from naturally durable or preservative treated wood.

2304.6.4 Wood in Contact with the Ground or Fresh Water. Wood in contact with the ground (exposed earth) that supports permanent structures shall be of naturally durable (species for both decay and termite resistant) or preservative-treated wood using water-borne preservatives and shall be treated in accordance with AWPA C2, C9 or other applicable AWPA standard for soil or fresh water contact, where used in the locations specified in 780 CMR 2304.6.4.1 and 2304.6.4.2.

Exception. Untreated wood is permitted where such wood is continuously and entirely below the ground water level or submerged in fresh water.

2304.6.4.1 Posts or Columns. Posts and columns supporting permanent structures that are embedded in concrete in direct contact with the earth or embedded in concrete exposed to the weather, or in direct contact with the earth, shall be of preservative-treated wood.

2304.6.4.2 Wood Structural Members. Wood structural members that support moisture-permeable floors or roofs that are exposed to the weather, such as concrete or masonry slabs, shall be of naturally durable or preservative-treated wood unless separated from such floors or roofs by an impervious moisture barrier.

2304.6.5 Supporting Member for Permanent Appurtenances. Naturally durable or preservative-treated wood shall be utilized for those portions of wood members that form the structural supports of buildings, balconies, porches, or similar permanent building appurtenances where such members are exposed to the weather without adequate protection from a roof, eave, overhead or other covering to prevent moisture or water accumulation on the surface or at joints between members.

2304.6.6 Wood Used in Retaining Walls and Cribs. Wood installed in retaining or crib walls shall be of preservative-treated wood treated in accordance with AWPA C2 or C9 for soil and fresh water contact.

2304.7 Wood Supporting Masonry or Concrete. Wood members shall not be used to permanently support the dead load of any masonry or concrete.

Exceptions:

1. Masonry or concrete nonstructural floor or roof surfacing not more than four inches (102 mm) thick is permitted to be supported by wood members.
2. Any structure is permitted to rest upon wood piles constructed in accordance with the requirements of 780 CMR 18.00.
3. Glass unit masonry having an installed weight of 20 pounds per square foot (0.96 kN/m^2) or less is permitted to be installed in accordance with the provisions of 780 CMR 21.00. The wood construction supporting the glass unit masonry shall be designed to support the additional weight of the glass unit masonry plus any other loads and designed to limit deflection and shrinkage to the smaller of $^1/_{600}$ of the span of the supporting members *or* 0.3 inches.

2304.8 Wood Construction in Foundations. Wood construction is not permitted for basement walls and foundations of buildings, except for piles and poles.

2304.9 Shrinkage. Consideration shall be given in design to the possible effect of cross-grain dimensional changes considered vertically which may occur in lumber fabricated in a green condition.

2304.9.1. Wood walls and bearing partitions shall not support more than two floors and a roof unless an analysis satisfactory to the building official shows that shrinkage of the wood framing will not have adverse effects on the structure or any plumbing, electrical or mechanical systems, or other equipment installed therein due to excessive shrinkage or differential movements caused by shrinkage. The analysis shall also show that the roof drainage system and the foregoing systems or equipment will not be adversely affected or, as an alternate, such systems shall be designed to accommodate the differential shrinkage or movements.

780 CMR 2305.0 GENERAL DESIGN REQUIREMENTS FOR LATERAL-FORCE-RESISTING SYSTEMS

23305.1 General. Structures using wood shear walls and diaphragms to resist wind, seismic and other lateral loads, shall be designed and constructed in accordance with the provisions of 780 CMR 2305.0 and 2306.0. Alternatively, compliance with the AF&PA SDPWS shall be permitted, except that the determination of shear capacity as described in the second sentence of AF&PA SDPWS, section 4.1.2 shall not be permitted.

2305.1.1 Framing. Boundary elements shall be provided to transmit tension and compression forces. Perimeter members at openings shall be provided and shall be detailed to distribute the shearing stresses. Diaphragm and shear wall sheathing shall not be used to splice boundary elements. Diaphragm chords and collectors shall be placed in, or tangent to, the plane of the diaphragm framing unless it can be demonstrated that the moments, shears, and deformations, considering eccentricities resulting from other configurations can be tolerated without exceeding the adjusted resistance and drift limits.

2305.1.1.1 Framing Members. Framing members shall be at least two-inch (51 mm) nominal width. In general, adjoining panel edges shall bear and be attached to the framing members and butt along their center lines. Nails shall be placed not less than ⅜ inch (9.5 mm) from the panel edge, not more than 12 inches (305 mm) apart along intermediate supports, and 6 inches (152 mm) along panel edge bearings, and shall be firmly driven into the framing members.

2305.1.3 Openings in Shear Panels. Openings in shear panels that materially affect their strength shall be fully detailed on the plans, and shall have their edges adequately reinforced to transfer all shearing stresses.

2305.1.4 Shear Panel Connections. Positive connections and anchorages, capable of resisting the design forces, shall be provided between the shear panel and the attached components. Toenails shall not be used to

transfer lateral forces in excess of 150 pounds per foot (2189 N/m) from diaphragms to shear walls, drag struts (collectors) or other elements, or from shear walls to other elements.

2305.1.5 Wood Members Resisting Horizontal Seismic Forces Contributed by Masonry and Concrete. Wood shear walls, diaphragms, horizontal trusses and other members shall not be used to resist horizontal seismic forces contributed by masonry or concrete construction in structures over one story in height.

Exceptions:

1. Wood floor and roof members are permitted to be used in horizontal trusses and diaphragms to resist horizontal seismic forces contributed by masonry or concrete construction provided such forces do not result in torsional force distribution through the truss or diaphragm.
2. ***Wood structural panel sheathed shear walls are permitted to be used to provide resistance to seismic forces contributed by masonry or concrete construction in two-, three-, and four story structures of masonry or concrete construction, provided the following requirements are met***:
    - 2.1. Story-to-story wall heights shall not exceed 12 feet (3658 mm).
    - 2.2. Diaphragms shall not be designed to transmit lateral forces by rotation. Diaphragms shall not cantilever past the outermost supporting shear wall.
    - **2.3. Combined deflections of diaphragms and shear walls shall not permit story drift of supported masonry or concrete walls to exceed the limit of Table 9.5.2.8 of ASCE 7.**
    - 2.4 Wood structural panel sheathing in diaphragms shall have unsupported edges blocked. Wood structural panel sheathing for all stories of shear walls shall have unsupported edges blocked and, for the lowest story, shall have a minimum thickness of $^{15}/_{32}$ inch (11.9 mm).
    - 2.5. There shall be no out-of-plane horizontal offsets between the first and second stories of wood structural panel shear walls.
    - 2.6 Concrete and masonry shear walls shall be continuous to the foundation.

2305.1.6 Wood Members Resisting Seismic Forces from Non-structural Concrete or Masonry. Wood members shall be permitted to resist horizontal seismic forces from non-structural concrete, masonry veneer or concrete floors.

2305.2 Design of Wood Diaphragms.

2305.2.1 General. Wood diaphragms are permitted to be used to resist horizontal forces provided the deflection in the plane of the diaphragm, as determined by calculations, tests, or analogies drawn therefrom, does not exceed the permissible deflection of attached distributing or resisting elements. Connections shall extend into the diaphragm a sufficient distance to develop the force transferred into the diaphragm.

2305.2.2 Deflection. Permissible deflection shall be that deflection up to which the diaphragm and any attached distributing or resisting element will maintain its structural integrity under design load conditions, such that the resisting element will continue to support design loads without danger to occupants of the structure. Calculations for diaphragm deflection shall account for the usual bending and shear components as well as any other factors, such as nail deformation, which will contribute to deflection.

The deflection (D) of a blocked wood structural panel diaphragm uniformly nailed throughout is permitted to be calculated by the use of the following formula. If not uniformly nailed, the constant 0.188 (For SI: 1/1627) in the third term must be modified accordingly.

EQUATION 23-1

$$\Delta + \frac{5vL^3}{8EAb} + \frac{vL}{4Gt} + 0.188Le_n + \frac{\sum(\Delta_c X)}{2b}$$

For SI:

$$\Delta = \frac{0.052vL^3}{EAb} + \frac{vL}{4Gt} + \frac{Le_n}{1627} + \frac{\sum(\Delta_c X)}{2b}$$

where:

A = Area of chord cross section, in square inches (mm^2).

b = Diaphragm width, in feet (mm).

E = Elastic modulus of chords, in pounds per square inch (N/mm^2).

e_n = Nail or staple deformation, in inches (mm). (See Table 2305.2.2(2))

Gt = Panel ridgidity through the thickness, in pounds per inch (N/mm) of panel width or depth. (See Table 2305.2.2(1)).

L = Diaphragm length, in feet (mm).

v = Maximum shear due to design loads in the direction under consideration, in pounds per lineal foot (plf) (N/mm).

Δ = The calculated deflection, in inches (mm).

$\sum(\Delta_c X)$ = ***Sum of individual chord-splice slip values on both sides of the diaphragm, each multiplied by its distance to the nearest support.***

TABLE 2305.2.2(1) e_n VALUES (INCHES) FOR USE IN CALCULATING DIAPHRAGM DEFLECTION DUE TO FASTENER SLIP (STRUCTURAL I)[a,d]

LOAD PER FASTENER [c] (pounds)	FASTENER DESIGNATIONS[b]			
	6d	8d	10d	14-Ga staple x 2 inches long
60	0.012	0.008	0.006	0.011
80	0.020	0.012	0.010	0.018
100	0.030	0.018	0.013	0.028
120	0.045	0.023	0.018	0.04
140	0.068	0.031	0.023	0.053
160	0.102	0.041	0.029	0.068
180	-	0.056	0.037	-
200	-	0.075	0.470	-
220	-	0.096	0.060	-
240	-	-	0.077	-

For SI: 1 inch - 25.4 mm, 1 foot = 305 mm, 1 pound = 4.448 N

a. Increase "e_n" values 20% for plywood grades other than Structural I.

b. Nail values apply to common wire nails or staples identified,

c. Load per fastener = maximum shear per foot divided by the number of fasteners per foot at internor panel edges.

d. Decrease e_n values 50% for seasoned lumber (moisture content < 19%).

TABLE 2305.2.2(2) VALUES OF *Gt* FOR USE ON CALCULATING DEFLECTION OF WOOD STRUCTURAL PANEL SHEAR WALLS AND DIAPHRAGMS

PANEL TYPE	SPAN RATING	VALUES OF *Gt* (lb./in. panel depth or width)							
		OTHER				STRUCTURAL			
		3-ply plywood	4-ply plywood	5-ply plywood	OSB	3-ply plywood	4-ply plywood	5-ply plywood[a]	OSB
SHEATH-ING	24/0	25000	32500	37500	77500	32500	42500	41500	77500
	24/16	27000	35000	40500	83500	35000	45500	44500	83500
	32/16	27000	35000	40500	83500	35000	45500	44500	83500
	40/20	28500	37000	43000	88500	37000	48000	47500	88500
	48/24	31000	40500	46500	96000	40500	52500	51000	96000
Single Floor	16 O.C	27000	35000	40500	8.500	35000	45500	44500	83500
	20 O C	28000	36500	42000	87000	36500	47500	46000	87000
	24 O.C	30000	39000	45000	93000	39000	50500	49500	93000
	32 O.C	26000	47000	54000	110000	47000	61000	59500	110000
	48 O.C	50500	65500	76000	155000	65500	85000	83500	155000

		Other			**Structural I**		
	Thickness (in.)	**A-A, A-C**	**Marine**	**All Other Grades**	**A-A, A-C**	**Marine**	**All Other Grades**
Sanded Plywood	¼	24000	31000	24000	31000	31000	31000
	11/32	25500	33000	25500	33000	33000	33000
	38054	26000	34000	26000	34000	34000	34000
	15/32	3800	49500	38000	49500	49500	49500
	½	38500	50000	38500	50000	50000	50000
	19/32	49000	63500	49000	63500	63500	63500
	⅝	49500	64500	49500	64500	64500	64500
	23/32	50500	65500	50500	65500	65500	65500
	¾	51000	66500	51000	66500	66500	66500
	⅞	52500	68500	52500	68500	68500	68500
	1	73500	95500	73500	95500	95500	95500
	1⅛	75000	97500	75000	97500	97500	97500

For SI: 1 inch = 25.4 mm, 1 pound/inch - 0.1751 N/mm.

a. Applies to plywood with five or more layers; for five ply/three layer plywood, use values for four ply.

2305.2.3 Diaphragm Aspect Ratios. Size and shape of diaphragms shall be limited as set forth in Table 2305.2.3.

TABLE 2305.2.3 MAXIMUM DIAPHRAGM DIMENSION RATIOS HORIZONTAL AND SLOPED DIAPHRAGM

TYPE	MAXIMUM LENGTH - WIDTH RATIO
Wood structural panel, nailed all edges	4:1
Wood structural panel, blocking omitted at intermediate joints	3:1
Diagonal sheathing, single	3:1
Diagonal sheathing, double	4:1

2305.2.4 Construction. Shear panels shall be constructed of wood structural panels, manufactured with exterior glue, not less than four by eight feet (1219 mm by 2438 mm), except at boundaries and changes in framing. Boundary elements shall be connected at corners. Wood structural panel thickness for horizontal diaphragms shall not be less than set forth in 780 CMR 2301.2.1(2) or 2301.2.2(5) for corresponding joist spacing and loads, except that ¼-inch (6.4 mm) is permitted to be used where perpendicular loads permit. Sheet-type sheathing shall be arranged so that the width of a sheet in a shear wall shall not be less than two feet (610 mm).

2305.2.5 Rigid Diaphragms. Design of structures with rigid diaphragms shall conform to the structure configuration requirements and the horizontal shear distribution requirements of 780 CMR 1615.0.

Open front structures with rigid wood diaphragms resulting in torsional force distribution are permitted provided the length, l, of the diaphragm normal to the open side does not exceed 25 feet (7620 mm), the diaphragm sheathing conforms to 780 CMR 2305.2.4, and the l/w ratio (as shown in Figure 2305.2.5(1)) is less than 1.0 for one-story structures or 0.67 for structures over one story in height.

> **Exception.** Where calculations show that diaphragm deflections can be tolerated, the length, l, normal to the open end is permitted to be increased to a l/w ratio not greater than 1.5 where sheathed in conformance with 780 CMR 2305.2.4 or to 1.0 where sheathed in conformance with 780 CMR 2306.3.4 or 2306.3.5.

Rigid wood diaphragms are permitted to cantilever past the outermost supporting shear wall (or other vertical-resisting element) a length, l, of not more than 25 feet (7620 mm) or two-thirds of the diaphragm width, w, whichever is the smaller. Figure 2305.2.5(2) illustrates the dimensions of l and w for a cantilevered diaphragm.

Structures with rigid wood diaphragms having a torsional irregularity in accordance with Table 1616.5.1, Item 1, shall meet the following requirements: The l/w ratio shall not exceed 1.0 for one-story structures or 0.67 for structures over one story in height, where l is the dimension parallel to the load direction for which the irregularity exists.

Exception. Where calculations demonstrate that the diaphragm deflections can be tolerated, the width is permitted to be increased and the *l/w* ratio is permitted to be increased to 1.5 where sheathed in conformance with 780 CMR 2305.2.4 or 1.0 where sheathed in conformance with 780 CMR 2306.3.4 or 2306.3.5.

2305.3 Design of Wood Shear Walls.

2305.3.1 General. ***Wood shear walls are permitted to resist horizontal forces in vertical distributing or resisting elements, provided the deflection in the plane of the shear wall, as determined by calculations, tests, or analogies drawn therefrom, does not exceed the more restrictive of the permissible deflection of attached distributing or resisting elements or the drift limits of ASCE 7, Section 9.5.2.8. Shear wall sheathing other than wood structural panels shall not be permitted.***

Exception. Buildings of conventional light-frame wood construction may have shear wall sheathing of diagonal wood sheathing, metal lath and plaster, gypsum lath, gypsum sheathing, gypsum board, hardboard, or particleboard providing all of the following conditions are met:

1. The building shall not be more than 35 feet in height.
2. The shear walls shall not provide lateral load resistance for more than three framed levels (floors or roof). In this context, a pitched roof shall be considered a "level." Where attics are habitable, the pitched roof and attic floor shall be considered separate levels.
3. The location of the shear walls shall be limited to exterior walls, fire walls or fire partitions.
4. The building is not in Seismic Use Group III.
5. The dead load of each level (floor or roof), supported laterally by the shear walls, shall not be more than 25 psf. Where attics are not habitable, the dead load of a pitched roof shall include the dead load of the attic floor.

FIGURE 2305.2.5(1) DIAPHRAGM LENGTH AND WIDTH FOR PLAN VIEW OF OPEN FRONT BUILDING

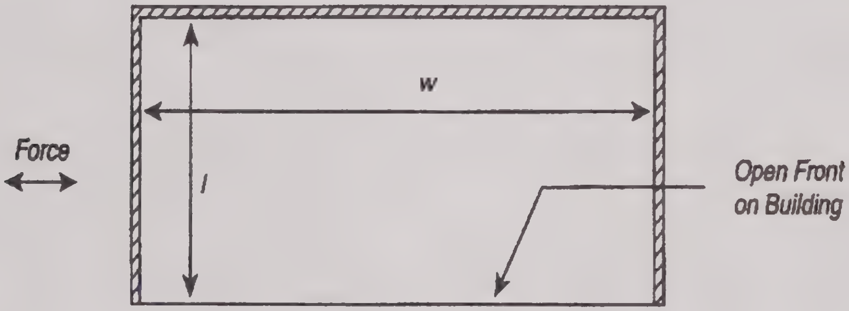
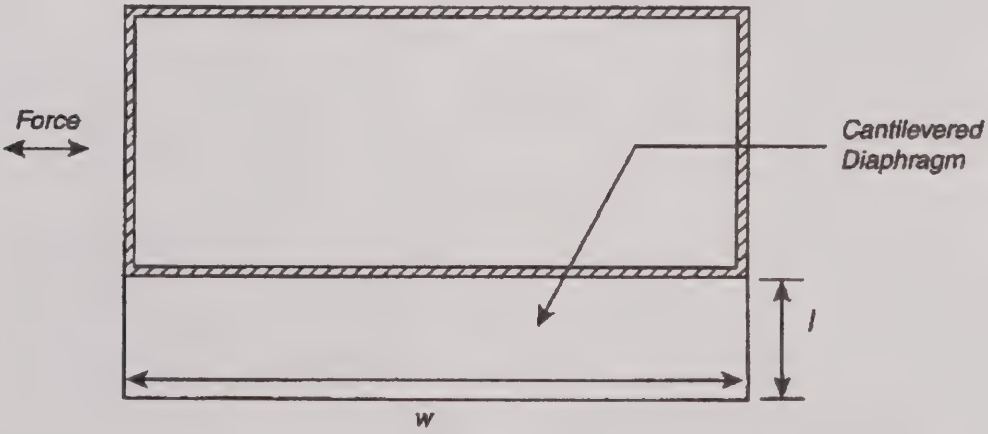


FIGURE 2305.2.5(2) DIAPHRAGM LENGTH AND WIDTH FOR PLAN VIEW OF CANTILEVERED DIAPHRAGM



2305.3.2 Deflection. Permissible deflection shall be that deflection up to which the shear wall and any attached distributing or resisting element will maintain its structural integrity under design load conditions, *i.e.*, continue to support design loads without danger to occupants of the structure.

The deflection (Δ) of a blocked wood structural panel shear wall uniformly fastened throughout is permitted to be calculated by the use of the following equation:

EQUATION 23-2

$$\Delta = \frac{8vh^3}{EAb} + \frac{vh}{Gt} + 0.75he_n\, d_a$$

For SI: $$\Delta = \frac{vh^3}{3EAb} + \frac{vh}{Gt} + \frac{he_n}{406.7} + d_a$$

where:

A = Area of boundary element cross section in square inches (mm$^{2)}$ (vertical member at shear wall boundary).

b = Wall width, in feet (mm).

d_a = Vertical elongation of overturning anchorage (including fastener slip, device elongation, anchor rod elongation, etc.) at the design shear load (v).

E = Elastic modulus of boundary element (vertical member at shear wall boundary), in pounds per square inch (N/mm^2).

e_n = Deformation of mechanically fastened connections, in inches (mm^2). (See Table 2305.2.2(1).)

Gt = Panel rigidity through the thickness, in pounds per inch (N/mm) of panel width or depth. (See Table 2305.2.2(2).)

h = Wall height, in feet (mm).

v = Maximum shear due to design loads at the top of the wall, in pounds per lineal foot (N/mm).

Δ = The calculated deflection, in inches (mm).

2305.3.3 Shear Wall Aspect Ratios. Size and shape of shear walls, perforated wall shear wall segments within perforated shear walls and wall piers within shear walls with openings designed for force transfer around openings shall be limited as set forth in Table 2305.3.3. The height, *h*, and the width, *w*, shall be determined in accordance with 780 CMR 2305.3.4 through 2305.3.4.2 and 780 CMR 2305.3.5 through 2305.3.5.2, respectively.

TABLE 2305.3.3 MAXIMUM SHEAR WALL ASPECT RATIOS

TYPE	MAXIMUM HEIGHT WIDTH RATIO
Wood structural panels or particleboard, nailed edges	For other than seismic: 3½ For seismic: 2:1[a]
Diagonal sheathing, single	2:1
Fiberboard, gypsum board, gypsum lath, cement plaster	1½:1[b]

a. For design to resist seismic forces, shear wall aspect ratios greater than 2:1 but not exceeding 3½:1, are permitted provided that the factored shear resistance values in 780 CMR 2306.4.1 are multiplied by 2w/h.

b. Ratio shown is for unblocked construction. Height-to-width ratio is permitted to be 2:1 where the wall is installed as blocked construction in accordance with 780 CMR 2306.4.5.1.2.

2305.3.4 Shear Wall Height Definition. The height of a shear wall, *h*, shall be defined as:

1. The maximum clear height from top of foundation to bottom of diaphragm framing above; or
2. The maximum clear height from top of diaphragm to bottom of diaphragm framing above. (See Figure 2305.3.4(a).)

2305.3.4.1 Perforated Shear Wall Segment Height Definition. The height of a perforated shear wall segment, h, shall be defined as specified in 780 CMR 2305.3.4 for shear walls.

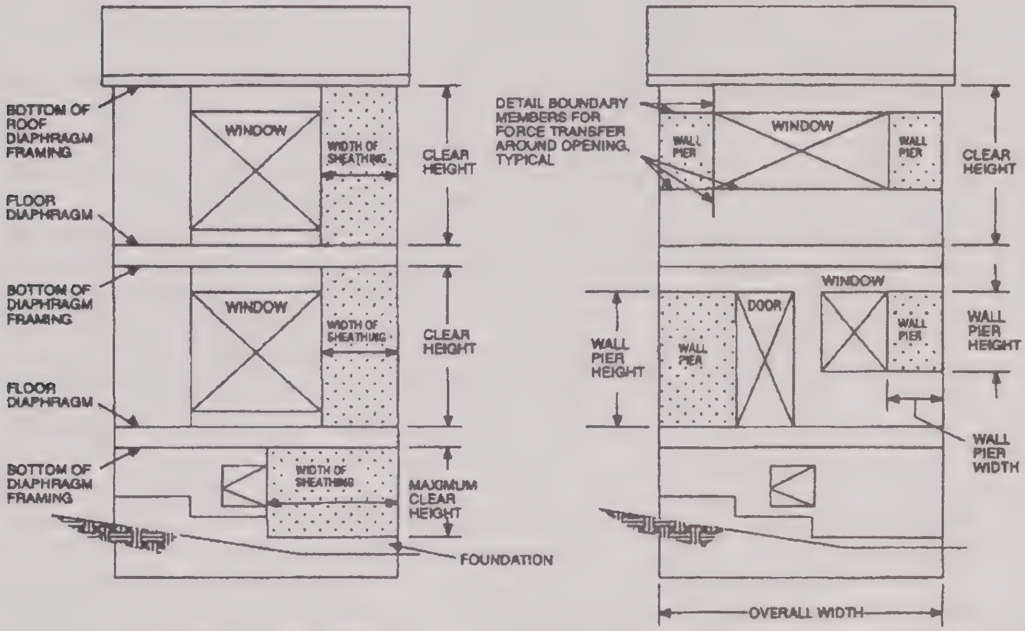
2305.3.4.2 Force Transfer Shear Wall Pier Height Definition. The height, *h*, of a wall pier in a shear wall with openings designed for force transfer around openings shall be defined as the clear height of the pier at the side of an opening [See Figure 2305.3.4(b)].

2305.3.5 Shear Wall Width Definition. The width of a shear wall, *w*, shall be defined as the sheathed dimension of the shear wall in the direction of application of force. (See Figure 2305.3.4(a).)

2305.3.5.1 Perforated Shear Wall Segment Width Definition. Shear wall segment width definition. The width of a perforated shear wall segment, w, shall be defined as the width of full height sheathing adjacent to openings in the perforated shear wall (See Figure 2305.3.4(a).)

2305.3.5.2 Force Transfer Shear Wall Pier Width Definition. The width, *w*, of a wall pier in a shear wall with openings designed for force transfer around openings shall be defined as the sheathed width of the pier at the side of an opening (See Figure 2305.3.4(b).)

FIGURE 2305.3.4 GENERAL DEFINITION OF SHEAR WALL HEIGHT, WIDTH AND HEIGHT -TO-WIDTH RATIO


BOTTOM OF ROOF DIAPHRAGM FRAMING
FLOOR DIAPHRAGM
BOTTOM OF DIAPHRAGM FRAMING
FLOOR DIAPHRAGM
BOTTOM OF DIAPHRAGM FRAMING
WINDOW
WIDTH OF SHEATHING
CLEAR HEIGHT
WINDOW
WIDTH OF SHEATHING
CLEAR HEIGHT
WIDTH OF SHEATHING
MAXIMUM CLEAR HEIGHT
FOUNDATION
DETAIL BOUNDARY MEMBERS FOR FORCE TRANSFER AROUND OPENING, TYPICAL
WALL PIER
WINDOW
WALL PIER
CLEAR HEIGHT
WINDOW
DOOR
WALL PIER
WALL PIER
WALL PIER HEIGHT
WALL PIER HEIGHT
WALL PIER WIDTH
OVERALL WIDTH

(a) HEIGHT-TO-WIDTH RATIO

(b) HEIGHT-TO-WIDTH RATIO WITH DESIGN FOR FORCE TRANSFER AROUND OPENINGS

2305.3.6 Overturning Restraint. Where the dead load stabilizing moment in accordance with 780 CMR 16.00 design load combinations is not sufficient to prevent uplift due to overturning moments on the wall, an anchoring device shall be provided. Anchoring devices shall maintain a continuous load path from the roof to the foundation.

2305.3.7 Shear Walls with Openings. The provisions of 780 CMR 2305.3.7 shall apply to the design of shear walls with openings. Where framing and connections around the openings are designed for force transfer around the openings, the provisions of 780 CMR 2305.3.7.1 shall apply. Where framing and connections around the opening are not designed for force transfer around the openings, the provisions of 780 CMR 2305.3.7.2 shall apply.

2305.3.7.1 Force Transfer Around Openings. Where shear walls with openings are designed for force transfer around the openings, the limitations of Table 2305.3.3 shall apply to the overall shear wall including openings and to each wall pier at the side of an opening. Design for force transfer shall be based on a rational analysis. Detailing of boundary elements around the opening shall be provided in accordance with the provisions of 780 CMR 2305.3.7.1 (See Figure 2305.3.4(b).)

2305.3.7.2 Perforated Shear Walls. The provisions of 780 CMR 2305.3.7.2 shall be permitted to be used for the design of perforated shear walls. For the determination of the height and width of perforated shear wall segments, see 780 CMR 2305.3.4.1 and 2305.3.5.1, respectively.

2305.3.7.2.1 Limitations. The following limitations shall apply to the use of 780 CMR 2305.3.7.2:

1. A perforated shear wall segment shall be located at each end of a perforated shear wall. Openings shall be permitted to occur beyond the ends of the perforated shear wall; however, the width of such openings shall not be included in the width of the perforated shear wall.
2. The allowable shear set forth in Table 2306.4.1 shall not exceed 490 plf (7150 N/m).
3. Where out-of-plane offsets occur, portions of the wall on each side of the offset shall be considered as separate perforated shear walls.
4. Collectors for shear transfer shall be provided through the full length of the perforated shear wall.
5. A perforated shear wall shall have uniform top of wall and bottom of wall elevations. Perforated shear walls not having uniform elevations shall be designed by other methods.
6. Perforated shear wall height, *h*, shall not exceed 20 feet (6096 mm).

2305.3.7.2.2 Perforated Shear Wall Resistance. The resistance of a perforated shear wall shall be calculated in accordance with the following:

1. The percent of full-height sheathing shall be calculated as the sum of the widths of perforated shear wall segments divided by the total width of the perforated shear wall including openings.
2. The maximum opening height shall be taken as the maximum opening clear height. Where areas above and below an opening remain unsheathed, the height of opening shall be defined as the height of the wall.
3. The unadjusted shear resistance shall be the allowable shear set forth in Table 2306.4.1 for height-to-width ratios of perforated shear wall segments that do not exceed 2:1 for seismic forces and 3½:1 for other than seismic forces. For seismic forces, where the height-to-width ratio of any perforated shear wall segment used in the calculation of the sum of the widths of perforated shear wall segments, ΣL_i is greater than 2:1 but not exceeding 3½:1, the unadjusted shear resistance shall be multiplied by two w/h.
4. The adjusted shear resistance shall be calculated by multiplying the unadjusted shear resistance by the shear resistance adjustment factors of Table 2305.3.7.2. For intermediate percentages of full height sheathing, the values in Table 2305.3.7.2 are permitted to be interpolated.
5. The perforated shear wall resistance shall be equal to the adjusted shear resistance times the sum of the widths of the perforated shear wall segments.

2305.3.7.2.3 Anchorage and Load Path. Design of perforated shear wall anchorage and load path shall conform to the requirements of 780 CMR 2305.3.7.2.4 through 2305.3.7.2.8, or shall be calculated using principles of mechanics. Except as modified by 780 CMR 2305.3.7.2.4 through 2305.3.7.2.8, wall framing, sheathing, sheathing attachment and fastener schedules shall conform to the requirements of 780 CMR 2305.2.4 and Table 2306.4.1.

2305.3.7.2.4 Uplift Anchorage at Perforated Shear Wall Ends. Anchorage for uplift forces due to overturning shall be provided at each end of the perforated shear wall. The uplift anchorage shall conform to the requirements of 780 CMR 2305.3.6 except that for each story the minimum tension chord uplift force, T, shall be calculated in accordance with the following:

EQUATION 23-3

$$T = Vh/\Sigma C_o L_i$$

where:

T = Tension chord uplift force, pounds (N).
V = Shear force in perforated shear wall, pounds (N).
h = Perforated shear wall height, feet (mm).
C_o = Shear resistance adjustment factor from Table 2305.3.7.2.
ΣL_i = Sum of widths of perforated shear wall segments, feet (mm).

2305.3.7.2.5 Anchorage for In-plane Shear. The unit shear force, v, transmitted into the top of a perforated shear wall, out of the base of the perforated shear wall at full-height sheathing, and into collectors (drag struts) connecting shear wall segments, shall be calculated in accordance with the following:

EQUATION 23-4

$$v = V/C_o \Sigma L_i$$

where:

v = Unit shear force, pounds per lineal feet (N/m).
V = Shear force in perforated shear wall, pounds (N).
C_o = Shear resistance adjustment factor from Table 2305.3.7.2.
ΣL_i = Sum of widths of perforated shear wall segments, feet (mm).

2305.3.7.2.6 Uplift Anchorage Between Perforated Shear Wall Ends. In addition to the requirements of 780 CMR 2305.3.7.2.4, perforated shear wall bottom plates at full-height sheathing shall be anchored for a uniform uplift force, t, equal to the unit shear force, v, determined in 780 CMR 2305.3.7.2.5.

2305.3.7.2.7 Compression Chords. Each end of each perforated shear wall segment shall be designed for a compression chord force, C, equal to the tension chord uplift force, T, calculated in 780 CMR 2305.3.7.2.4.

2305.3.7.2.8 Load Path. A load path to the foundation shall be provided for each uplift force, T and t, for each shear force, V and v, and for each compression chord force, C. Elements resisting shear wall forces contributed by multiple stories shall be designed for the sum of forces contributed by each story.

2305.3.7.2.9 Deflection of Shear Walls with Openings. The controlling deflection of a blocked shear wall with openings uniformly nailed throughout shall be taken as the maximum individual deflection of the shear wall segments calculated in accordance with 780 CMR 2305.3.2, divided by the appropriate shear resistance adjustment factors of Table 2305.3.7.2.

TABLE 2305.3.7.2 SHEAR RESISTANCE FACTOR, C_o

WALL HEIGHT, H	MAXIMUM OPENING HEIGHT[a]				
	H/3	H/2	2H/3	5H/6	H
8' wall	2'-8"	4'-0"	5'-4"	6'-8"	8'-0"
10' wall	3'-4"	5'-0"	6'-8"	8'-4"	10'-0"
Percentage full-height sheathing[b]	Shear resistance adjustment factor				
10%	1.00	0.69	0.53	0.43	0.36
20%	1.00	0.71	0.56	0.45	0.38
30%	1.00	0.74	0.59	0.49	0.42
40%	1.00	0.77	0.63	0.53	0.45
50%	1.00	0.8	0.67	0.57	0.5
60%	1.00	0.83	0.71	0.63	0.56
70%	1.00	0.87	0.77	0.69	0.63
80%	1.00	0.91	0.83	0.77	0.71
90%	1.00	0.95	0.91	0.87	0.83
100%	1.00	1.00	1.00	1.00	1.00

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

a. See 780 CMR 2305.3.7.2.2, Item 2.

b. See 780 CMR 2305.3.7.2.2, Item 1.

2305.3.8 Summing Shear Capacities. The shear values for shear panels of different capacities applied to the same side of the wall are not cumulative except as allowed in Table 2306.4.1.

The shear values for material of the same type and capacity applied to both faces of the same wall are cumulative. Where the material capacities are not equal, the allowable shear shall be either two times the smaller shear capacity or the capacity of the stronger side, whichever is greater.

Summing shear capacities of dissimilar materials applied to opposite faces or to the same wall line is not allowed.

Exception. For wind design of structures described in the Exception to 780 CMR 2305.3.1, the allowable shear capacity of shear wall segments sheathed with a combination of wood structural panels and gypsum wall board on opposite faces shall equal the sum of the sheathing capacities of each face separately.

2305.3.9 Adhesives. Adhesive attachment of shear wall sheathing is not permitted as a substitute for mechanical fasteners, and shall not be used in shear wall strength calculations alone, or in combination with mechanical fasteners.

2305.3.10 Sill Plate Size and Anchorage. Two inch (51 mm) nominal wood sill plates for shear walls shall include steel plate washers, a minimum of $^3/_{16}$ inch by two inches by two inches (4.76 mm by 51 mm by 51 mm) in size, between the sill plate and nut. Sill plates resisting a design load greater than 490 plf (LRFD) (7154 N/m) or 350 plf (ASD) (5110 N/m) shall not be less than a three inch (76 mm) nominal member. Where a single three inch (76 mm) nominal sill plate is used, 2-20d box end nails shall be substituted for 2-16d common end nails found in line 8 of Table 2304.5.

Exception. In shear walls where the design load is less than 840 plf (LRFD) (12 264 N/m) or 600 plf (ASD) (8760 N/m), the sill plate is permitted to be a two inch (51 mm) nominal member if the sill plate is anchored by two times the number of bolts required by design and $^3/_{16}$ inch by two inches by two inches (4.76 mm by 51 mm by 51 mm) plate washers are used.

780 CMR 2306.0 CAPACITY AND CONSTRUCTION OF LATERAL FORCE RESISTING SYSTEMS

2306.1 General Criteria. The capacities given in this section are for ASD. For LRFD (strength design), the nominal strength (reference resistance) is equal to the allowable shear capacities given in 780 CMR 2306.0 times 2.0. The factored resistance is the nominal strength multiplied by the resistance factor, ϕ, equal to 0.65.

2306.1.1 Adjustment of Design Values. The values in the tables of 780 CMR 2306.1 are for the Temperature Factor, C_t, equal 1.0 and the Wet Service factor, C_M, equal 1.0. The values in the tables shall be adjusted for conditions when these factors are less than 1.0. The values in the tables have been adjusted for load duration; no further adjustments are permitted.

2306.2 Wind Provisions for Walls.

2306.2.1 Wall Stud Bending Stress Increase. The NDS fiber stress in bending (F_b) design values for wood studs resisting out of plane wind load can be increased by the factors in Table 2306.2.1, in lieu of the 1.15 repetitive member factor, to take into consideration the load sharing and composite actions provided by the wood structural panels as defined in 780 CMR 2302.1, where the studs are spaced no more than

16 inches (406 mm) on center, covered on the inside with a minimum of ½ inch (12.7 mm) gypsum board fastened in accordance with Table 2306.4.5, and sheathed on the exterior with a minimum of ⅜ inch (9.5 mm) wood structural panel sheathing that is attached to the studs using a minimum of 8d common nails spaced a maximum of six inches on center (152 mm) at panel edges and 12 inches on center (305 mm) in the field of the panels.

TABLE 2306.2.1 WALL STUD BENDING STRESS INCREASE FACTORS

STUD SIZE	SYSTEM FACTOR
2 x 4	1.5
2 x 6	1.4
2 x 8	1.3
2 x 10	1.2
2 x 12	1.15

2306.3 Wood Diaphragms.

2306.3.1 Shear Capacities Modifications. The allowable shear capacities in Tables 2306.3.1, 2306.3.1a, and 2306.3.1b for horizontal wood structural panel diaphragms shall be increased 40% for wind design.

2306.3.2 Wood Structural Panel Diaphragms. Structural panel diaphragms with wood structural panels are permitted to be used to resist horizontal forces not exceeding those set forth in Tables 2306.3.1, 2306.3.1a, 2306.3.1b or 2306.3.2.

2306.3.3 Diagonally Sheathed Lumber Diaphragms. Diagonally sheathed lumber diaphragms shall be nailed in accordance with Table 2306.3.3.

2306.3.4 Single Diagonally Sheathed Lumber Diaphragms. Single diagonally sheathed lumber diaphragms shall be constructed of minimum one-inch (25 mm) thick nominal sheathing boards laid at an angle of approximately 45 degrees (0.78 radians) to the supports. The shear capacity for single diagonally sheathed lumber diaphragms of southern pine or Douglas fir-larch shall not exceed 300 pounds per linear foot (4378 N/m) of width. The shear capacities shall be adjusted by reduction factors of 0.82 for framing members of species with a specific gravity equal to or greater than 0.42 but less than 0.49 and 0.65 species with a specific gravity of less than 0.42, as contained in the NDS.

2306.3.4.1 End Joints. End joints in adjacent boards shall be separated by at least one stud or joist space and there shall be at least two boards between joints on the same support.

2306.3.4.2 Single Diagonally Sheathed Lumber Diaphragms. Single diagonally sheathed lumber diaphragms made up of two-inch (51 mm) nominal diagonal lumber sheathing fastened with 16d nails shall be designed with the same shear capacities as shear panels using one-inch (25 mm) boards fastened with 8d nails, provided there are not splices in adjacent boards on the same support and the supports are not less than four inch (102 mm) nominal depth or three inch (76 mm) nominal thickness.

2306.3.5 Double Diagonally Sheathed Lumber Diaphragms. Double diagonally sheathed lumber diaphragms shall be constructed of two layers of diagonal sheathing boards at 90 degrees (1.57 rad) to each other on the same face of the supporting members. Each chord shall be considered as a beam with uniform load per foot equal to 50% of the unit shear due to diaphragm action. The load shall be assumed as acting normal to the chord in the plan of the diaphragm in either direction. The span of the chord or portion thereof shall be the distance between framing members of the diaphragm, such as the joists, studs, and blocking that serve to transfer the assumed load to the sheathing. The shear capacity of double diagonally sheathed diaphragms of southern pine or Douglas fir-larch shall not exceed 600 pounds per linear foot (8756 kN/m) of width. The shear capacity shall be adjusted by reduction factors of 0.82 for framing members of species with a specific gravity equal to or greater than 0.42 but less than 0.49 and 0.65 for species with a specific gravity of less than 0.42, as contained in the NDS. Nailing of diagonally sheathed lumber diaphragms shall be in accordance with Table 2306.3.3.

2306.3.6 Gypsum Board Diaphragm Ceilings. Gypsum board diaphragm ceilings shall be in accordance with 780 CMR 2508.5, but may only be used for ceilings below attics without floor diaphragms.

2306.4 Shear Walls. See 780 CMR 2305.3.1 for limitations on shear wall bracing materials. Panel sheathing joints in shear walls shall occur over studs or blocking. Adjacent panel sheathing joints shall occur over and be nailed to common framing members.

2306.4.1 Wood Structural Panel Shear Walls. Wood structural panels shall be fastened directly to wood framing; fastening through other sheathing materials is not permitted. The allowable shear capacities for wood structural panel shear walls shall be in accordance with Tables 2306.4.1, 2306.4.1a, and 2304.1b. These capacities are permitted to be increased 40% for wind design.

2306.4.2 Lumber Sheathed Shear Walls. Single and double diagonally sheathed lumber diaphragms shall be in accordance with the construction and allowable load provisions of

780 CMR 2306.3.4 and 2306.3.5.

2306.4.3 Particleboard Shear Walls. The design shear capacity of particleboard shear walls shall be in accordance with Table 2306.4.3. Shear panels shall be constructed with particleboard sheets not less than four by eight feet (1219 by 2438 mm), except at boundaries and changes in framing. Particleboard panels shall be designed to resist shear only, and chords, collector members, and boundary elements shall be connected at all corners. Panel edges shall be backed with two-inch (51 mm) nominal or wider framing. Sheets are permitted to be installed either horizontally or vertically. For ⅜-inch (9.5 mm) particleboard sheets installed with the long dimension parallel to the studs spaced 24 inches (610 mm) on center along intermediate framing members. For all other conditions, nails of the same size shall be spaced at 12 inches (305 mm) on center along intermediate framing members. Particleboard panels less than 12 inches (305 mm) wide shall be blocked.

2306.4.4 Fiberboard Shear Walls. The design shear capacity of fiberboard shear walls shall be in accordance with Table 2308.9.3(4). The fiberboard sheathing shall be applied vertically or horizontally to wood studs not less than two-inch (51 mm) nominal thickness spaced 16 inches (406 mm) on center. Blocking not less than two-inch (51 mm) nominal in thickness shall be provided at horizontal joints.

2306.4.5 Shear Walls Sheathed with Other Materials. Shear capacities for walls sheathed with lath and plaster, and gypsum board shall be in accordance with Table 2306.4.5. Shear walls sheathed with lath, plaster and gypsum board shall be constructed in accordance with 780 CMR 25.00 and 780 CMR 2306.4.5.1.

2306.4.5.1 Application of Gypsum Board or Lath and Plaster to Wood Framing.

2306.4.5.1.1 Joint Staggering. End joints of adjacent courses of gypsum board shall not occur over the same stud.

2306.4.5.1.2 Blocking. Where required in Table 2306.4.5, wood blocking having the same cross-sectional dimensions as the studs shall be provided at joints that are perpendicular to the studs.

2306.4.5.1.3 Nailing. Studs, top and bottom plates and blocking shall be nailed in accordance with Table 2304.9.1.

2306.4.5.1.4 Fasteners. The size and spacing of nails shall be set forth in Table 2306.4.5. Nails shall be spaced not less than ⅜ inch (9.5 mm) from edges and ends of gypsum boards or sides of studs, blocking and top and bottom plates.

2306.4.5.1.5 Gypsum Lath. Gypsum lath shall be applied perpendicular to the studs. Maximum allowable shear values shall be set forth in Table 2306.4.5.

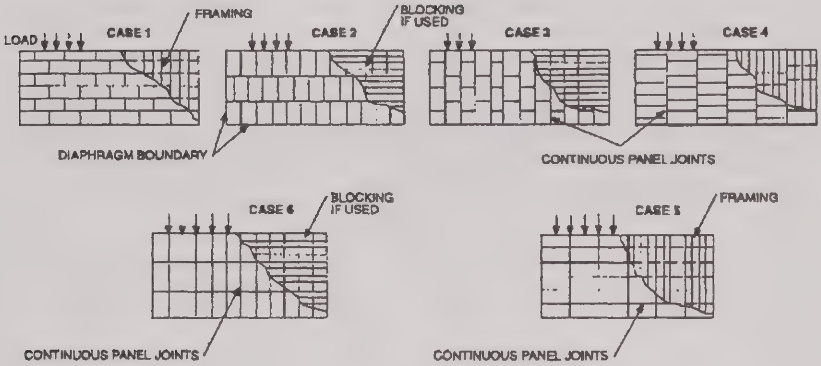
2306.4.5.1.6 Gypsum Sheathing. Four-foot-wide (1219 mm) pieces of gypsum sheathing shall be applied parallel or perpendicular to studs. Two-foot-wide (610 mm) pieces of gypsum sheathing shall be applied perpendicular to the studs. Maximum allowable shear values shall be as set forth in Table 2306.4.5.

2306.4.5.1.7 Other Gypsum Boards. Gypsum board shall be applied parallel or perpendicular to studs. Maximum allowable shear values shall be set forth in Table 2306.4.5.

TABLE 2306.3.1 RECOMMENDED SHEAR (POUNDS PER FOOT) FOR WOOD STRUCTURAL PANEL DIAPHRAGMS WITH FRAMING OF DOUGLAS-FIR-LARCH, OR SOUTHERN PINE[a] FOR WIND OR SEISMIC LOADING

PANEL GRADE	COMMON NAIL SIZE OR STAPLE[f] LENGTH AND GAGE	MINIMUM FASTENER PENETRATION IN FRAMING (inches)	MINIMUM NOMINAL PANEL THICKNESS (inch)	MINIMUM NOMINAL WIDTH OF FRAMING MEMBER (inches)	BLOCKED DIAPHRAGMS				UNBLOCKED DIAPHRAGMS	
					fastener spacing (inches) at diaphragm boundaries (all Cases) at continuous panel edges parallel to load (Cases 3, 4), and at all panel edges (Cases 5 and 6)[b]				Fasteners spaced at 6" max. at supported edges[b]	
					6	4	2½[c]	2[c]	Case 1 (no unblocked edges or continuous joints parallel to load)	All other configurations (Cases 2, 3, 4, 5 and8)
					Fastener spacing (inches) at other panel edges (Cases 1, 2, 3 and 4)[b]					
					6	6	4	3		
Structural 1 Grades	6d[e] (2" x 0.113")	1¼	$^5/_{16}$	2	185	250	375	420	165	125
				3	210	180	420	475	185	140
	1½ 16 Gage	1		2	155	205	310	350	135	105
				3	175	230	345	390	155	115
	8d (2½" x 0.131")	1⅜	⅜	2	270	360	530	600	240	180
				3	300	400	300	675	265	200
	1½ 16 Gage	1		2	175	235	350	400	155	115
				3	200	265	395	450	175	130
	10d[d] (3" x 0.148")	1½	$^{15}/_{32}$	2	320	425	640	7730	285	215
				3	360	480	720	820	320	240
	1½ 16 Gage	1		2	175	235	350	400	155	120
				3	200	265	395	450	175	130
Sheathinig, Single Floor and Other Grades Covered in DOC PS1 and PS2	6d[e] (2" x 0.113")	1¼	$^5/_{16}$	2	170	225	335	380	150	110
				3	190	250	380	430	170	125
	1½ 16 Gage	1		2	140	185	275	315	125	90
				3	155	205	310	350	140	105
	6d[e] (2" x 0.113")	1¼	⅜	2	185	250	375	420	165	125
				3	210	280	420	475	185	140
	8d (2½" x 0.131")	1⅜		2	240	320	480	545	215	160
				3	270	360	540	610	240	180
	1½ 16 Gage	1		2	160	210	315	360	140	105
				3	180	235	355	400	260	120
	8d (2½" x 0.131")	1⅜	$^7/_{16}$	2	255	340	505	575	230	170
				3	285	380	570	645	255	190
	1½ 16 Gage	1		2	165	225	335	380	150	110
				3	190	250	375	425	165	125
	8d (2½" x 0.131")	1⅜	$^{15}/_{32}$	2	270	360	430	600	240	180
				3	300	400	600	675	265	200
	10d[d] (3" x 0.148")	1½		2	290	385	575	655	255	190
				3	325	430	650	735	290	215
	1½ 16 Gage	1		2	160	210	315	360	140	105
				3	180	235	355	405	160	120
	10d[d] (3" x 0.148")	1½	$^{19}/_{32}$	2	320	425	640	730	285	215
				3	360	480	720	820	320	240
	1¾ 16 Gage	1		2	175	235	350	400	155	115
				3	200	265	395	450	175	130

TABLE 2306.3.1 RECOMMENDED SHEAR (POUNDS PER FOOT) FOR WOOD STRUCTURAL PANEL DIAPHRAGMS WITH FRAMING OF DOUGLAS-FIR-LARCH, OR SOUTHERN PINE[a] FOR WIND OR SEISMIC LOADING - continued



For SI: 1 inch = 25.4 mm, 1 pound per foot = 14.5939 N/m.

a. For framing of other species: (1) Find specific gravity for species of lumber in AFPA National Design Specification. (2) For staples find shear value from table above for Structural I panels (regardless of actual grade) and multiply value by 0.82 for species with specific gravity of 0.42 or greater, or 0.65 for all other spe cies. (3) For nails find shear value from table above for nail size for actual grade and multiply value by the following adjustment factor: Specific Gravity Ad justment Factor = [1-(0.5 - SG)], where SG = Specific Gravity of the framing lumber. This adjustment factor shall not be greater than 1.

b. Space fasteners maximum 12 inches o.c. along intermediate framing members (6 inches o.c. where supports are spaced 48 inches o.c.).Framing at adjoining panel edges shall be 3 inches nominal or wider, and nails shall be staggered where nails are spaced two inches o.c. or 2½ inches o.c.

c. Framing at adjoining panel edges shall be three inches nominal or wider, and nails shall be staggered where both of the following conditions are met: (1) 10d nails having penetration into framing of more than 1½ inches and (2) nails are spaced three inches o.c. or less.

d. 8d is recommended minimum for roofs due to negative pressures of high winds.

e. Staples shall have a minimum crown width of $^7/_{16}$ inch.

f. Staples shall have a minimum crown width of $^7/_{16}$ inch, and shall be installed with their crowns parallel to the long dimension of the framing members.

g. The minimum nominal width of framing members not located at boundaries or adjoining panel edges shall be two inches.

TABLE 2306.3.1a RECOMMENDED SHEAR (POUNDS PER FOOT) FOR NAILED WOOD STRUCTURAL PANEL DIAPHRAGMS WITH FRAMING OF SPRUCE-PINE-FIR (SPECIFIC GRAVITY = 0.42) FOR WIND OR SEISMIC LOADING

PANEL GRADE	MINIMUM NOMINAL PANEL THICKNESS (inch)	COMMON NAIL SIZE OR STAPLE[f] LENGTH AND GAGE	MINIMUM FASTENER PENETRATION IN FRAMING (inches)	MINIMUM NOMINAL WIDTH OF FRAMING MEMBER (inches)	BLOCKED DIAPHRAGMS				UNBLOCKED DIAPHRAGMS	
					fastener spacing (inches) at diaphragm boundaries (all Cases) at continuous panel edges parallel to load (Cases 3, 4), and at all panel edges (Cases 5 and 6)[b]				Fasteners spaced at 6" max. at supported edges[b]	
					6	4	2½[c]	2[c]	Case 1 (no unblocked edges or continuous joints parallel to load)	All other configurations (Cases 2, 3, 4, 5 and8)
					Fastener spacing (inches) at other panel edges (Cases 1, 2, 3 and 4)[b]					
					6	6	4	3		
Structural I Grades	5/16	6d[e] (2" x 0.113")	1¼	2 3	170 190	230 255	345 385	385 435	150 170	115 125
	⅜	8d (2½" x 0.131")	1⅜	2 3	245 275	330 365	485 550	550 620	220 240	165 180
	15/32	10d[d] (3" x 0.148")	1½	2 3	290 330	390 440	585 660	670 750	260 290	195 220
Sheathinig, Single Floor and Other Grades Covered in DOC PS1 and PS2	5/16	6d[e] (2" x 0.113")	1¼	2 3	155 170	205 230	305 345	345 395	135 155	100 115
	⅜	6d[e] (2" x 0.113")	1¼	2 3	170 190	230 255	345 385	385 435	150 170	115 125
		8d (2½" x 0.131")	1⅜	2 3	220 245	290 330	440 495	500 560	195 220	145 165
	7/16	8d (2½" x 0.131")	1⅜	2 3	230 260	310 345	460 520	525 590	210 230	155 170
	15/32	8d (2½" x 0.131")	1⅜	2 3	245 275	330 365	485 550	550 620	220 240	165 180
		10d[d] (3" x 0.148")	1½	2 3	265 295	350 395	525 595	600 675	230 265	170 195
	19/32	10d[d] (3" x 0.148")	1½	2 3	290 330	390 440	585 660	670 750	260 290	195 220

For SI: 1 inch 25.4 mm, 1 pound per foot = 14.5939 N/m.

For foot notes, see Table 2306.3.1

TABLE 2306.3.1b RECOMMENDED SHEAR (POUNDS PER FOOT) FOR STAPLED WOOD STRUCTURAL PANEL DIAPHRAGMS WITH FRAMING OF SPRUCE-PINE-FIR (SPECIFIC GRAVITY = 0.42) FOR WIND OR SEISMIC LOADING

PANEL GRADE	MINIMUM NOMINAL PANEL THICKNESS (inch)	STAPLE[f] LENGTH AND GAGE	MINIMUM FASTENER PENETRATION IN FRAMING (inches)	MINIMUM NOMINAL WIDTH OF FRAMING MEMBER (inches)	BLOCKED DIAPHRAGMS				UNBLOCKED DIAPHRAGMS	
					fastener spacing (inches) at diaphragm boundaries (all Cases) at continuous panel edges parallel to load (Cases 3, 4), and at all panel edges (Cases 5 and 6)[b]				Fasteners spaced at 6" max. at supported edges[b]	
					6	4	2½[c]	2[c]	Case 1 (no unblocked edges or continuous joints parallel to load)	All other configurations (Cases 2, 3, 4, 5 and8)
					Fastener spacing (inches) at other panel edges (Cases 1, 2, 3 and 4)[b]					
					6	6	4	3		
Structural I Grades	$^5/_{16}$	1½ 16 Gage	1	2	125	165	250	285	110	85
				3	140	185	280	315	125	90
	⅜	1½ 16 Gage)	1	2	140	190	285	325	125	90
				3	160	215	320	365	140	105
	$^{15}/_{32}$	1½ 16 Gage	1	2	140	190	285	325	125	95
				3	160	215	320	365	140	105

For Sl: 1 inch 25.4 mm, 1 pound per foot = 14.5939 N/m.

For foot notes, see Table 2306.3.1

TABLE 2306.3.2 ALLOWABLE SHEAR IN POUNDS PER FOOT FOR HORIZONTAL BLOCKED DIAPHRAGMS UTILIZING MULTIPLE ROWS OF FASTENERS (HIGH LOAD DIAPHRAGMS) WITH FRAMING OF DOUGLAS FIR, LARCH OR SOUTHERN PINE[a] FOR WIND OR SEISMIC LOADING[b]

PANEL GRADE[c]	FASTENER AND SIZE	MINIMUM FASTENER PENETRATION IN FRAMING (inches)	MINIMUM NOMINAL PANEL THICKNESS (inch)	MINIMUM NOMINAL WIDTH OF FRAMING MEMBER[e] (inches)	LINES OF FASTENERS	BLOCKED DIAPHRAGMS					
						Cases 1 and 2[d]					
						Fastener Spacing Per Line at Boundaries (inches)					
						4		2½		2	
						Fastener Spacing Per Line at Other Panel Edges (inches)					
						6	4	4	3	3	2
Structural 1 grades	10d common nails	1½	$^{15}/_{32}$	3	2	605	815	875	1150	—	—
				4	2	700	915	1005	1290	—	—
				4	3	875	1220	1285	1395	—	—
			$^{19}/_{32}$	3	2	670	880	965	1255	—	—
				4	2	780	990	1110	1440	—	—
				4	3	965	1320	1405	1790	—	—
			$^{23}/_{32}$	3	2	730	955	1050	1365	—	—
				4	2	855	1070	1210	1565	—	—
				4	3	1050	1430	1525	1800	—	—
	14 gage staples	2	$^{15}/_{32}$	3	2	600	600	860	960	1060	1200
				4	3	860	900	1160	1295	1295	1400
			$^{19}/_{32}$	3	2	600	600	875	960	1075	1200
				4	3	875	900	1175	1440	1475	1795
Sheathing single floor and other grades covered in DOC PS 1 and PS 2	10d common nails	$1^{1'}{}_{2}$	$^{15}/_{32}$	3	2	525	725	765	1010	—	—
				4	2	605	815	875	1105	—	—
				4	3	765	1085	1130	1195	—	—
			$^{19}/_{32}$	3	2	650	860	935	1225	—	—
				4	2	755	965	1080	1370	—	—
				4	3	935	1290	1365	1485	—	—
			$^{23}/_{32}$	3	2	710	935	1020	1335	—	—
				4	2	825	1050	1175	1445	—	—
				4	3	1020	1400	1480	1565	—	—
	14 gage staples	2	$^{15}/_{32}$	3	2	540	540	735	865	915	1080
				4	3	735	810	1005	1105	1105	1195
			$^{19}/_{32}$	3	2	600	600	865	960	1065	1200
				4	3	865	900	1130	1430	1370	1485
			$^{23}/_{32}$	4	3	865	900	1130	1490	1430	1545

For SI: 1 inch = 25.4 mm, 1 pound per foot = 14.5939 N/m.

a. For framing of the other species: (1) Find specific gravity for species of framing lumber in AFPA National Design Specification, (2) Find shear value from Table 2306.3.2 for nail size of actual grade, and (3) Multiply value by the following adjustment factor = [1 -(0.5- *SG)*], where *SG* = Specific gravity of the framing lumber. This adjustment factor shall not be greater than 1.

b. Fastening along intermediate framing members: Space nails 12 inches on center, except 6 inches on center for spans greater than 32 inches.

c. Panels conforming to PS 1 or PS 2.

d. Table 2306.3.2 gives shear values for Cases 1 and 2 as shown in Table 2306.3.1. The values shown are applicable to Cases 3, 4, 5 and 6 as shown in Table 2306.3.1, pro viding fasteners at all continuous panel edges are spaced in accordance with the boundary fastener spacing.

e. The minimum depth of framing members shall be three inches.

TABLE 2306.3.3 DIAGONALLY SHEATHED LUMBER DIAPHRAGM NAILING SCHEDULE

SHEATHING NOMINAL DIMENSION	NAILING TO INTERMEDIATE AND END-BEARING STUDS		NAILING AT THE SHEAR PANEL BOUNDARIES	
	Type, size and number of nails per board			
	Common nails	Box nails	Common nails	Box nails
1 × 6	two - 8d	three - 8d	three - 8d	five - 8d
1 × 8	three - 8d	four - 8d	four - 8d	six - 8d
2 × 6	two - 16d	three - 16d	three - 16d	five - 16d
2 × 8	three - 16d	four - 16d	four - 16d	six - 16d

TABLE 2306.4.1 ALLOWABLE SHEAR (POUNDS PER FOOT) FOR WOOD STRUCTURAL PANEL SHEAR WALLS WITH FRAMING OF DOUGLAS-FIR-LARCH, OR SOUTHERN PINE[a] FOR WIND OR SEISMIC LOADING [b, h, i, j]

PANEL GRADE	MINIMUM NOMINAL PANEL THICKNESS (inches)	MINIMUM FASTENER PENETRATION IN FRAMING (inches)	PANELS APPLIED DIRECT TO FRAMING				
			Nail (common or galvanized box) or staple size[k]	Fastener spacing at panel edges (inches)			
				6	4	3	2[e]
Structural 1 Sheathing	5/16	1¼	6d (2" x 0.113" common, 2" - 0.099" galvanized box)	200	300	390	510
		1	1½ 16 Gage	165	245	325	415
	⅜	1⅜	8d (2½" x 0.131" common, 2½" - 0.113" galvanized box)	230[d]	360[d]	460[d]	610[d]
		1	1½ 16 Gage	155	235	315	400
	7/16	1⅜	8d (2½" x 0.131" common, 2½" - 0.113" galvanized box)	255[d]	395[d]	505[d]	670[d]
		1	1½ 16 Gage	170	260	345	440
	15/32	1⅜	8d (2½" x 0.131" common, 2½" - 0.113" galvanized box)	280	430	550	730
			10d (3" x 0.148" common, 3" - 0.128" galvanized box)	850	280	375	475
		1	1½ 16 Gage	340	510	665[f]	870
Sheathing, Plywood Siding except Group 5 Species	5/16 or ¼[c]	1¼	6d (2" x 0.113" common, 2" - 0.099" galvanized box)	180	270	350	450
		1	1½ 16 Gage	145	220	295	375
	⅜	1¼	6d (2" x 0.113" common, 2" - 0.099" galvanized box)	200	300	390	510
		1 ⅜	8d (2½" x 0.131" common, 2½" - 0.113" galvanized box)	220[d]	320[d]	410[d]	530[d]
		1	1½ 16 Gage	140	210	280	360
	7/16	1 ⅜	8d (2½" x 0.131" common, 2½" - 0.113" galvanized box)	240[d]	350[d]	450[d]	585[d]
		1	1½ 16 Gage	155	230	310	395
	15/32	1 ⅜	8d (2½" x 0.131" common, 2½" - 0.113" galvanized box)	260	380	490	640
		1½	10d (3" x 0.148" common, 3" - 0.128" galvanized box)	310	460	600[f]	770
		1	1½ 16 Gage	170	255	335	430
	19/32	1½	10d (3" x 0.148" common, 3" - 0.128" galvanized box)	340	510	665[f]	870
		1	1½ 16 Gage	185	280	375	475
			Nail size (ga;vanized casing)				
	5/16[c]	1¼	6d (2" - 0.099")	140	210	275	360
	⅜	1 ⅜	8d (2½" - 0.113")	160	40	310	410

For SI: 1 inch = 25.4 mm, 1 pound per foot = 14.5939 N/m.

a. For framing of the other species: (1) Find specific gravity for species of lumber in NDS. (2) For staples find shear value from Table 2306.4.1 for Structural 1 panels (regardless of actual grade) and multiply value by 0.82 for species with specific gravity of 0.42 or greater, or 0.65 for all other species. (3) For nails find shear value from Table 2306.4.1 for nail size for actual grade, and multiply value by the following adjustment factor: Specific Gravity Adjustment Factor = [1 -(0.5- *SG)*], where *SG* = Specific gravity of the framing lumber. This adjustment factor shall not be greater than 1.

b. panel edges backed with two-inch nominal or wider framing. Instal; panels either horizontally or vertically. Space nails maximum six inches o.c. along intermediate framing members for ⅜-inch and 7/16-inch panels installed on studs spaced 24 inches o.c. For other conditions and panel thickness, space nails maximum 12 o.c. on intermediate supports..

c. ⅜-inch or siding 16 inches o.c. is minimum recommended where applied direct to framing as exterior siding.

d. Allowable shear values are permitted to be increased to values shown for 15/32-inch sheathing with same nailing provided (a) studs are spaced at a maximum of 16 inches o.c., or (b) if panels are applied with long dimension across studs.

e. Framing at adjoining panel edges shall be three-inch nominal or wider, and nails shall be staggered where nails are spaces two-inches.

f. Framing at adjoining panel edges shall be three-inch nominal or wider, and nails shall be staggered where both of the following conditions are met: (1) 10d (3" x 0.148") nails having penetration into framing of more than 1½ inches and (2) nails are spaces three inches o.c.

g. Values apply to all-veneer plywood. Thickness at point of nailing on panel edges governs shear values.

h. Where panels are applied on both faces of a wall and nail spacing is less than six inches o.c. on either side, panel joists shall be offset to fail on different framing members, or framing shall be three-inch nominal or thicker at adjoining panel edges and nails on each side shall be staggered.

i. In Seismic Design Category D, E, or F, where shear design values exceed 490 pounds per lineal foot (LRFD) or 350 pounds per lineal foot (ASD) all framing members receiving edge nailing from abutting panels shall not be less that a single three-inch nominal member, or two-inch nominal members fastened together in accordance with 780 CMR 2307.1 (LFRD) or 780 CMR 2308.1 (ASD) to transfer the design shear value between framing members. Plywood joint and sill plate nailing shall be staggered in all cases. Dee 780 CMR 2305.3.10 for sill plate size and anchorage requirements.

j. Galvanized nails shall be hot-dipped or tumbled.

k. Staples shall have a minimum crown width of 7/16inch, and shall be installed with their growns parallel to the long dimension of the framing members.

TABLE 2306.4.1a ALLOWABLE SHEAR (POUNDS PER FOOT) FOR NAILED WOOD STRUCTURAL PANEL SHEAR WALLS WITH FRAMING OF SPRUCE-PINE-FIR (SPECIFIC GRAVITY = 0.42) FOR WIND OR SEISMIC LOADING [b, h. I, j]

PANEL GRADE	MINIMUM NOMINAL PANEL THICKNESS (inches)	MINIMUM FASTENER PENETRATION IN FRAMING (inches)	PANELS APPLIED DIRECT TO FRAMING				
			Nail (common or galvanized box)	Fastener spacing at panel edges (inches)			
				6	4	3	2[e]
Structural 1 Sheathing	5/16	1¼	6d (2" x 0.113" common, 2" - 0.099" galvanized box)	180	275	355	465
	⅜	1⅜	8d (2½" x 0.131" common, 2½" - 0.113" galvanized box)	210[d]	330[d]	420[d]	560[d]
	7/16	1⅜	8d (2½" x 0.131" common, 2½" - 0.113" galvanized box)	230[d]	360[d]	460[d]	615[d]
	15/32	1⅜	8d (2½" x 0.131" common, 2½" - 0.113" galvanized box)	255	395	505f	670
			10d (3" x 0.148" common, 3" - 0.128" galvanized box)	310	465	610f	800
Sheathing, Plywood Siding except Group 5 Species	5/16 or ¼[c]	1¼	6d (2" x 0.113" common, 2" - 0.099" galvanized box)	165	245	320	410
	⅜	1¼	6d (2" x 0.113" common, 2" - 0.099" galvanized box)	180	275	355	465
		1⅜	8d (2½" x 0.131" common, 2½" - 0.113" galvanized box)	200[d]	290[d]	375[d]	485[d]
	7/16	1⅜	8d (2½" x 0.131" common, 2½" - 0.113" galvanized box)	220[d]	320[d]	410[d]	535[d]
	15/32	1⅜	8d (2½" x 0.131" common, 2½" - 0.113" galvanized box)	235	345	450[f]	585
		1½	10d (3" x 0.148" common, 3" - 0.128" galvanized box)	285	420	550[f]	705
	19/32	1½	1 10d (3" x 0.148" common, 3" - 0.128" galvanized box)	310	465	610[f]	800
			Nail size (ga;vanized casing)				
	5/16[c]	1¼	6d (2" - 0.099")	125	190	250	330
	⅜	1⅜	8d (2½" - 0.113")	145	220	285[f]	375

For SI: I inch = 25.4 turn, I pound per foot = 14.5939 N/m.

For footnotes, see Table 2306.4.1

TABLE 2306.4.1b ALLOWABLE SHEAR (POUNDS PER FOOT) FOR STAPLED WOOD STRUCTURAL PANEL SHEAR WALLS WITH FRAMING OF SPRUCE-PINE-FIR (SPECIFIC GRAVITY = 0.42) FOR WIND OR SEISMIC LOADING[b, h, i, j]

PANEL GRADE	MINIMUM NOMINAL PANEL THICKNESS (inches)	MINIMUM FASTENER PENETRATION IN FRAMING (inches)	PANELS APPLIED DIRECT TO FRAMING				
			STAPLE LENGTH AND GAGE[k]	Fastener spacing at panel edges (inches)			
				6	4	3	2[e]
All Sheathing and Plywood Siding[g] except Group 5 Species	$^5/_{16}$	1	1½ 16 Gage	135	200	265	340
	⅜	1	1½ 16 Gage	125	190	255	325
	$^7/_{16}$	1	1½ 16 Gage	135	210	280	360
	$^{15}/_{32}$	1	1½ 16 Gage	150	225	305	385

For SI: 1 inch = 25.4 turn, 1 pound per foot = 14.5939 N/m.

For footnotes, see Table 2306.4.1

TABLE 2306.4.3 ALLOWABLE SHEAR FOR PARTICLEBOARD SHEAR WALL SHEATHING[b]

PANEL GRADE	MINIMUM NOMINAL PANEL THICKNESS (inch)	MINIMUM NAIL PENETRATION IN FRAMING (inches)	PANELS APPLIED DIRECT TO FRAMING				
			Nail size (common or galvanized box)	Allowable shear (pounds per foot) nail spacing at panel edges (inches)[a]			
				6	4	3	2
M-S "Exterior Glue" and M-2 "Exterior Glue"	⅜	1 ½	6d	120	180	230	300
	⅜	1 ½	8d	130	190	240	315
	½			140	210	270	350
	½	1⅝	10d	185	275	360	460
	⅝			200	305	395	520

For SI: 1 inch = 25.4 turn, 1 pound per foot = 14.5939 N/m.

a. Values are not permitted in Seismic Design Category D, E, or F.

b Galvanized nails shall be hot-dipped or tumbled.

TABLE 2306.4.5 ALLOWABLE SHEAR FOR WIND OR SEISMIC FORCES FOR SHEAR WALLS OF LATH AND PLASTER OR GYPSUM BOARD WOOD FRAMED WALL ASSEMBLIES

TYPE OF MATERIAL	THICKNESS OF MATERIAL	WALL CONSTRUCTION	FASTENER SPACING[b] MAXIMUM (inches)	SHEAR VALUE[a,e] (plf)	MINIMUM FASTENER SIZE[c, d, j, k]
1. Expanded metal or woven wire lath and portland cement plaster	⅞"	Unblocked	6	180	No. 11 gage 1½" long, 7/16" head 16 Ga. Galv. Staple, ⅞ legs
2. Gypsum lath, plain or perforated	⅜" lath and ½" plaster	Unblocked	5	100	No. 13 gage, 1⅛" long, 19/64" head, plasterboard nail 16 Ga. Galv. Staple, 1⅛" long 0.120" Nail, min. ⅜" head, 1¼" long
3. Gypsum sheathing	½" x 2' x 8'	Unblocked	4	75	No. 11 gage, 1¾" long, 7/16" head, diamond-point, galvanized 16 Ga. Galv. Staple, 1¾" long
	½" × 4'	Blocked[f]	4	175	
		Unblocked	7	100	
	⅝" × 4'	Blocked	4ˆ edge/ 7ˆ field	200	6d galvanized 0.120" Nail, min. ⅜" head, 1¾" long
4. Gypsum board, gypsum veneer base, or water-resistant gypsum backing board	½"	Unblocked[f]	7	75	5d cooler (1⅝" x 0.086") or wallboard 0.120" Nail, min. ⅜" head, 1½" long 16 Gage Staple, 1½" long
		Unblocked[f]	4	110	
		Unblocked	7	100	
		Unblocked	4	125	
		Blocked[g]	7	125	
		Blocked[g]	4	150	
		Unblocked	8/12[h]	60	No. 6-1¼" screws[i]
		Blocked[g]	4/16[h]	160	
		Blocked[g]	4/12[h]	155	
		Blocked[f, g]	8/12[h]	70	
		Blocked[g]	6/12[h]	90	
	⅝"	Unblocked[f]	7	115	6d cooler (1⅞" x 0.092") or wallboard 0.120" Nail, min. ⅜" head, 1¾" long 16 Gage Staple, 1½" legs, 1⅝" long
			4	145	
		Blocked[g]	7	145	
			4	175	
		Blocked[g] Two-ply	Base ply: 9 Face ply: 7	250	Base ply—6d cooler (1⅞" x 0.092") or wallboard 1¾" × 0.120" Nail, min. ⅜" head 1⅝" 16 Ga. Galv. Staple Face ply—8d cooler (2⅜" x 0.113") or wallboard 0 120" Nail, min. ⅜" head, 2⅜" long 15 Ga. Galv. Staple, 2¼" long
		Unblocked	8/12[h]	70	No. 6-1¼" screws[i]
		Blocked[g]	8/12[h]	90	

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per foot = 14.5939 N/m.

a. These shear walls shall not be used to resist loads imposed by masonry or concrete construction (see 780 CMR 2305.1.5). Values shown are for short-term loading due to wind or seismic load. Walls resisting seismic loads shall be subject to the limitations in 780 CMR 1617.6. Values shown shall be reduced 25% for normal loading.

b. Applies to nailing at studs, top and bottom plates and blocking.

c. Alternate nails are permitted to be used if their dimensions are not less than the specified dimensions. Drywall screws are permitted to be substituted for the 5d, 6d (cooler) nails listed above. 1¼ inches Type S or W, No. 6 for 6d (cooler) nails.

d. For properties of cooler nails, see ASTM C 514.

e. Except as noted, shear values are based on a maximum framing spacing of 16 inches on center.

f. Maximum framing spacing of 24 inches on center.

g. All edges are blocked, and edge nailing is provided at all supports and all panel edges.

h. First number denotes fastener spacing at the edges; second number denotes fastener spacing in the field.

i. Screws are Type W or S.

j. Staples shall have a minimum crown width of 7/16 inch, measured outside the legs.

k. Staples for the attachment of gypsum lath and woven-wire lath shall have a minimum crown width of ¾ inch, measured outside the legs.

780 CMR 24.00

GLASS AND GLAZING

780 CMR 2401.0 GENERAL

2401.1 Scope. The provisions of 780 CMR 24.00 shall govern the materials, design, construction and quality of glass, light-transmitting ceramic and light-transmitting plastic panels for exterior and interior use in both vertical and sloped applications in buildings and structures.

> ***Note: For Fire Fighter protection, additional skylight live load requirements or barrier protection are set forth in 527 CMR.***

2401.2 Glazing Replacement. The installation of replacement glass shall be as required for new installations.

780 CMR 2402.0 DEFINITIONS

2402.1 Definitions. The following words and terms shall, for the purposes of 780 CMR 24.00 and as used elsewhere in 780 CMR, have the meanings shown in 780 CMR 2402.0.

DALLE GLASS. A decorative composite glazing material made of individual pieces of glass that are embedded in a cast matrix of concrete or epoxy.

DECORATIVE GLASS. A carved, leaded or Dalle glass or glazing material whose purpose is decorative or artistic, not functional; whose coloring, texture or other design qualities or components cannot be removed without destroying the glazing material and whose surface, or assembly into which it is incorporated, is divided into segments.

780 CMR 2403.0 GENERAL REQUIREMENTS FOR GLASS

2403.1 Identification. Each pane shall bear the manufacturer's label designating the type and thickness of the glass or glazing material. The identification shall not be omitted unless approved and an affidavit is furnished by the glazing contractor certifying that each light is glazed in accordance with approved construction documents that comply with the provisions of 780 CMR 24.00. Safety glazing shall be identified in accordance with 780 CMR 2406.2.

Each pane of tempered glass, except tempered spandrel glass, shall be permanently identified by the manufacturer. The identification label shall be acid etched, sand blasted, ceramic fired, embossed or shall be of a type that once applied cannot be removed without being destroyed.

Tempered spandrel glass shall be provided with a removable paper marking by the manufacturer.

2403.2 Glass Supports. Where one or more sides of any pane of glass are not firmly supported, or are subjected to unusual load conditions, detailed construction documents, detailed shop drawings and analysis or test data assuring safe performance for the specific installation shall be prepared by a registered design professional.

2403.3 Framing. To be considered firmly supported, the framing members for each individual pane of glass shall be designed so the deflection of the edge of the glass perpendicular to the glass pane shall not exceed $^1/_{175}$ of the glass edge length or ¾ inch (19.1 mm), whichever is less, when subjected to the larger of the positive or negative load where loads are combined as specified in 780 CMR 1605.0.

2403.4 Interior Glazed Areas. Where interior glazing is installed adjacent to a walking surface, the differential deflection of two adjacent unsupported edges shall not be greater than the thickness of the panels when a force of 50 pounds per linear foot (plf) (730 N/m) is applied horizontally to one panel at any point up to 42 inches (1067 mm) above the walking surface.

2403.5 Louvered Windows or Jalousies. Float, wired and patterned glass in louvered windows and jalousies shall be no thinner than nominal $^3/_{16}$ inch (4.8 mm) and no longer than 48 inches (1219 mm). Exposed glass edges shall be smooth.

Wired glass with wire exposed on longitudinal edges shall not be used in louvered windows or jalousies.

Where other glass types are used, the design shall be submitted to the building official for approval.

780 CMR 2404.0 WIND, SNOW, SEISMIC AND DEAD LOADS ON GLASS

2404.1 Vertical Glass. Glass sloped 15 degrees (0.26 rad) or less from vertical in windows, curtain and window walls, doors and other exterior applications shall be designed to resist the wind loads in 780 CMR 1609.0 for components and cladding. Glass in glazed curtain walls, glazed storefronts and glazed partitions shall meet the seismic requirements of ASCE 7, Section 9.6.2.10. Glazing firmly supported on all four edges is permitted to be designed by the following provisions. Where the glass is not firmly supported on all four edges, analysis or test data ensuring safe performance for the specific installation shall be prepared by a registered design professional.

The design of vertical glazing shall be based on the following equation:

EQUATION 24-1

$$F_{gw} \_ F_{ga}$$

where:

F_{gw} is the wind load on the glass computed in accordance with 780 CMR 1609 and F_{ga} is the maximum allowable load on the glass computed by the following Equation:

EQUATION 24-2

$$F_{ga} = c_1 F_{ge}$$

where:

F_{ge} = Maximum allowable equivalent load, pounds per square foot (psf) (kN/m^2) determined from Figures 2404(1) through 2404(12) for the applicable glass dimensions and thickness.

c_1 = Factor determined from Table 2404.1 based on glass type.

TABLE 2404.1 c_1 FACTORS FOR VERTICAL AND SLOPED GLASS

GLASS TYPE	FACTOR
Single Glass	
Regular (annealed)	1
Heat strengthened	2
Fully tempered	4
Wired	0.5
Patterned[c]	1
Sandblasted[d]	0.5
Laminated—regular plies[e]	0.7/0.90[f]
Laminated—heat-strengthened plies[e]	1.5/1 .8[f]
Laminated—fully tempered plies[e]	3.0/3.6[f]
Insulating Glass[b]	
Regular (annealed)	1.8
Heat strengthened	3.6
Fully tempered	7.2
Laminated—regular plies[e]	1.4/1 .6[f]
Laminated—heat-strengthened plies[e]	2.7/3.2[f]
Laminated—fully tempered plies[e]	5.4/6.5[f]

a. Either Table 2404.1 or 2404.2 shall be appropriate for sloped glass depending on whether the snow or wind load is dominant (see 780 CMR 2404.2). For glass types (vertical or sloped) not included in the tables, refer to ASTM E 1300 for guidance.

b. Values apply for insulating glass with identical panes.

c. The value for patterned glass is based on the thinnest part of the pattern; interpolation between graphs is permitted.

d. The value for sandblasted glass is for moderate levels of sandblasting.

e. Values for laminated glass are based on the total thickness of the glass and apply for glass with two equal glass ply thicknesses.

f. The lower value applies if, for any laminated glass pane, either the ratio of the long to short dimension is greater than 2.0 or the lesser dimension divided by the thickness of the pane is 150 or less; the higher value applies in all other cases.

2404.2 Sloped Glass. Glass sloped more than 15 degrees (0.26 rad) from vertical in skylights, sunrooms, sloped roofs and other exterior applications shall be designed to resist the most critical of the following combinations of loads.

EQUATION 24-3

$$F_g = W_o - D$$

EQUATION 24-4

$$F_g = W_i + D + 0.5\ S$$

EQUATION 24-5

$$F_g = 0.5\ W_i + D + S$$

where:

D = Glass dead load (psf) For glass sloped 30 degrees (0.52 rad) or less from horizontal,

$D = 13\ t_g$ (For SI: 0.0245 t_g) For glass sloped more than 30 degrees (0.52 rad) from horizontal,

$D = 13\ t_g \cos q$ (For SI: 0.0245 $t_g \cos q$).

F_g = Total load, psf (kN/m^2) on glass.

S = Snow load, psf (kN/m^2) as determined in 780 CMR 1608.

t_g = Total glass thickness, inches (mm) of glass panes and plies.

W_i = Inward wind force, psf (kN/m^2) as calculated in 780 CMR 1609.

W_o = Outward wind force, psf (kN/m^2) as calculated in 780 CMR 1609.

q = Angle of slope from horizontal.

Exception. Unit skylights shall be designed in accordance with 780 CMR 2405.5.

The design of sloped glazing shall be based on the following equation:

EQUATION 24-6

$$F_g \_ F_{ga}$$

where F_g is the maximum load on the glass determined from Equations 24-3 through 24-5, and F_{ga} is the maximum allowable load on the glass.

If Fg is determined by Equation 24-3 or 24-4 above, Fga shall be computed as for vertical glazing in 780 CMR 2404.1. If Fg is determined by Equation 24-5 above, Fga shall be computed by the following equation:

EQUATION 24-7

$$F_{ga} = c_2 F_{ge}$$

where:

F_{ge} = Maximum allowable equivalent load (psf) determined from Figures 2404(1) through 2404(12) for the applicable glass dimensions and thickness.

c_2 = Factor determined from Table 2404.2 based on glass type.

TABLE 2404.2 C_2 FACTORS FOR SLOPED GLASS

For use with Figures 2404(1) through 2404(12)

GLASS TYPE	FACTOR
Single Glass	
Regular (annealed)	0.6
Heat strengthened	1.6
Fully tempered	3.6
Wired	0.3
Patterned[c]	0.6
Laminated — regular plies[d]	0.3/0.45[e]
Laminated — heat-strengthened plies[d]	0 8/1 .2[e]
Laminated — fully tempered plies[d]	1.8/2.7[e]
Insulating Glass[b]	
Regular (annealed)	1.1
Heat strengthened	2.9
Fully tempered	6.5
Laminated — regular plies[d]	0.54/0.81[e]
Laminated — heat-strengthened plies[d]	1 .4/2.2[e]
Laminated — fully tempered plies[d]	3.3/4.9e

a. Either Table 2404.1 or 2404.2 shall be appropriate for sloped glass depending on whether the snow or wind load is dominant (see 780 CMR 2404.2). For glass types (vertical or sloped) not included in the tables, refer to ASTM E 1300 for guidance.

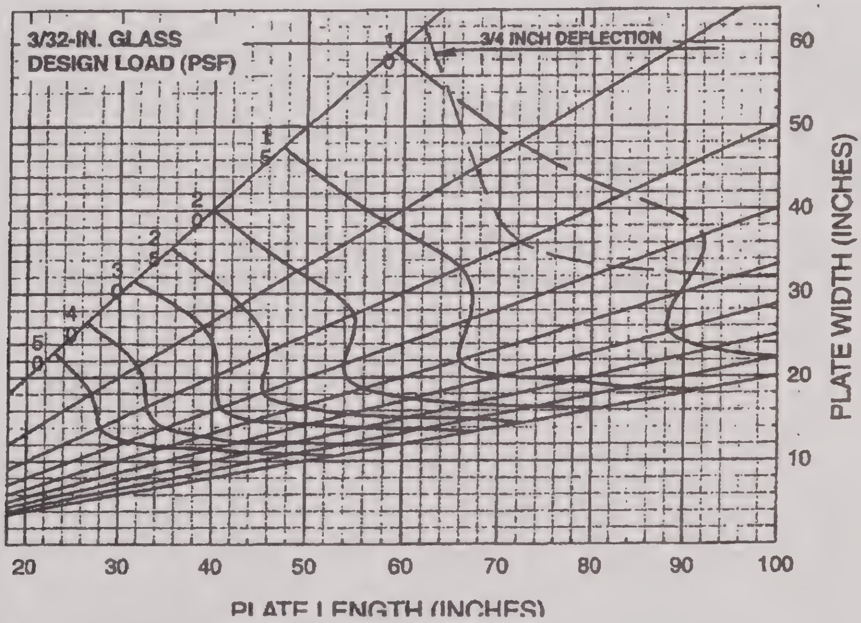
b. Values apply for insulating glass with identical panes.

c. The value for patterned glass is based on the thinnest part of the pattern; interpolation between graphs is permitted.

d. Values for laminated glass are based on the total thickness of the glass and apply for glass with two equal glass ply thicknesses.

e. The lower value applies where, for any laminated glass pane, either the ratio of the long to short dimension is greater than 2.0 or the lesser dimension divided by the thickness of the pane is 150 or less. The higher value applies in all other cases.

FIGURE 2404(1)[a, b, c, d, e, f] MAXIMUM ALLOWABLE LOAD FOR VERTICAL AND SLOPED RECTANGULAR GLASS SUPPORTED ON ALL EDGES



For SI: 1 inch = 25.4 mm, 1 pound per square foot - 0.0479 kPa.

a. In each graph, the vertical axis is the lesser dimension

b. The diagonal number on each graph shows the equivalent design load in psf/

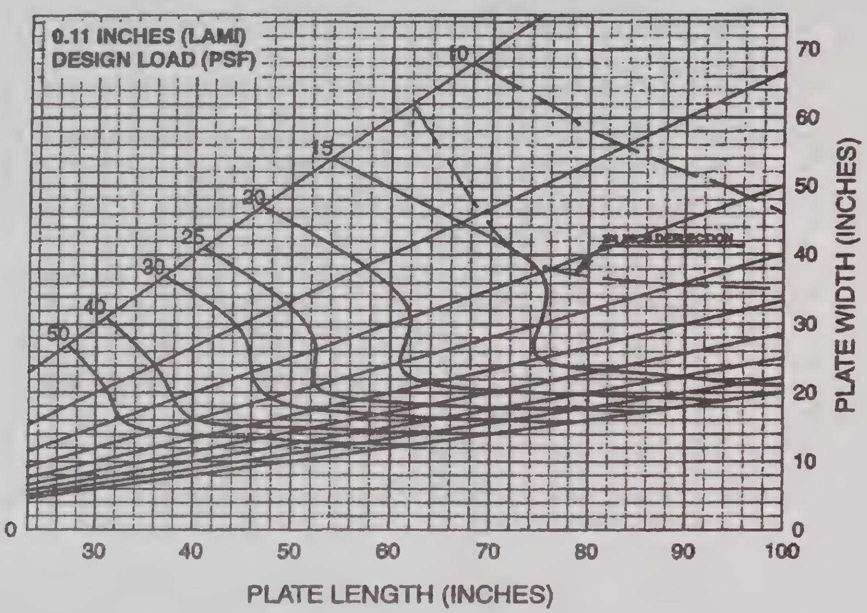
c. The dashed lines indicate glass that has deflection in excess of ¾ inch.

d. Interpolation between lines is permitted, Extrapolation Is not allowed.

e. For laminated glass, the applicable glass thickness is the total glass thickness.

f. For insulating glass panes, the applicable glass thickness is the thickness of one pane.

FIGURE 2404(2)[a, b, c, d, e, f] MAXIMUM ALLOWABLE LOAD FOR VERTICAL AND SLOPED RECTANGULAR GLASS SUPPORTED ON ALL EDGES



For SI: 1 inch = 25.4 mm, 1 pound per square foot - 0.0479 kPa.

a. In each graph, the vertical axis is the lesser dimension

b. The diagonal number on each graph shows the equivalent design load in psf/

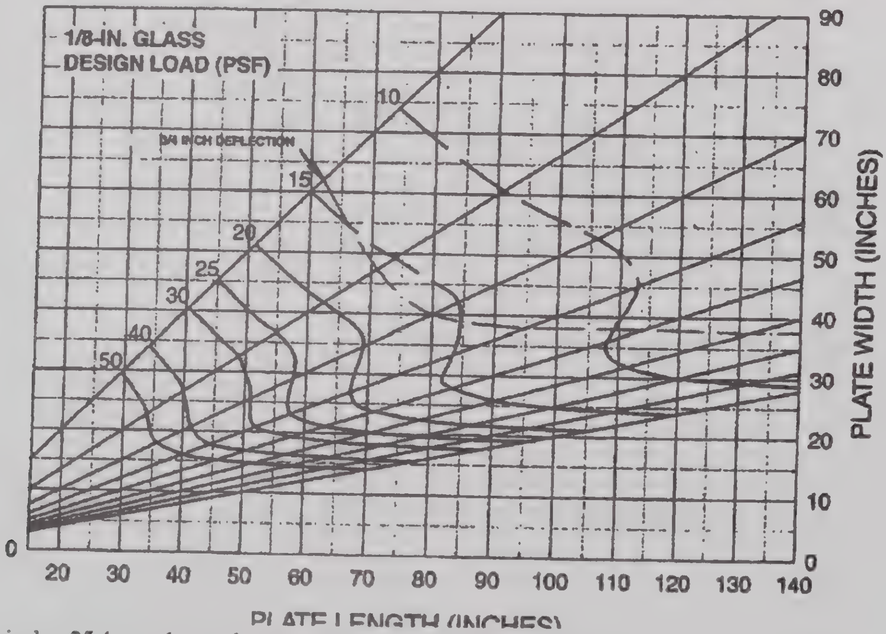
c. The dashed lines indicate glass that has deflection in excess of ¾ inch.

d. Interpolation between lines is permitted, Extrapolation Is not allowed.

e. For laminated glass, the applicable glass thickness is the total glass thickness.

f. For insulating glass panes, the applicable glass thickness is the thickness of one pane.

FIGURE 2404(3)[a, b, c, d, e, f] MAXIMUM ALLOWABLE LOAD FOR VERTICAL AND SLOPED RECTANGULAR GLASS SUPPORTED ON ALL EDGES



For SI: 1 inch = 25.4 mm, 1 pound per square foot - 0.0479 kPa.

a. In each graph, the vertical axis is the lesser dimension

b. The diagonal number on each graph shows the equivalent design load in psf/

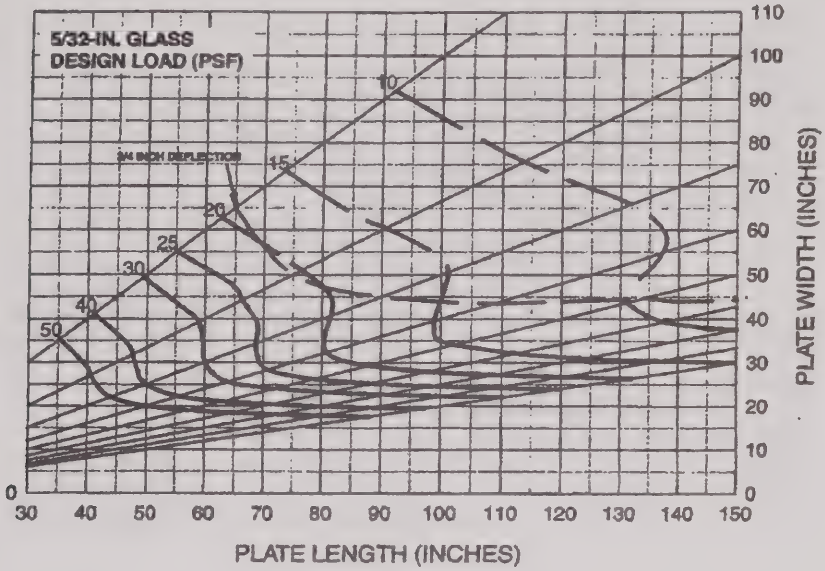
c. The dashed lines indicate glass that has deflection in excess of ¾ inch.

d. Interpolation between lines is permitted, Extrapolation Is not allowed.

e. For laminated glass, the applicable glass thickness is the total glass thickness.

f. For insulating glass panes, the applicable glass thickness is the thickness of one pane.

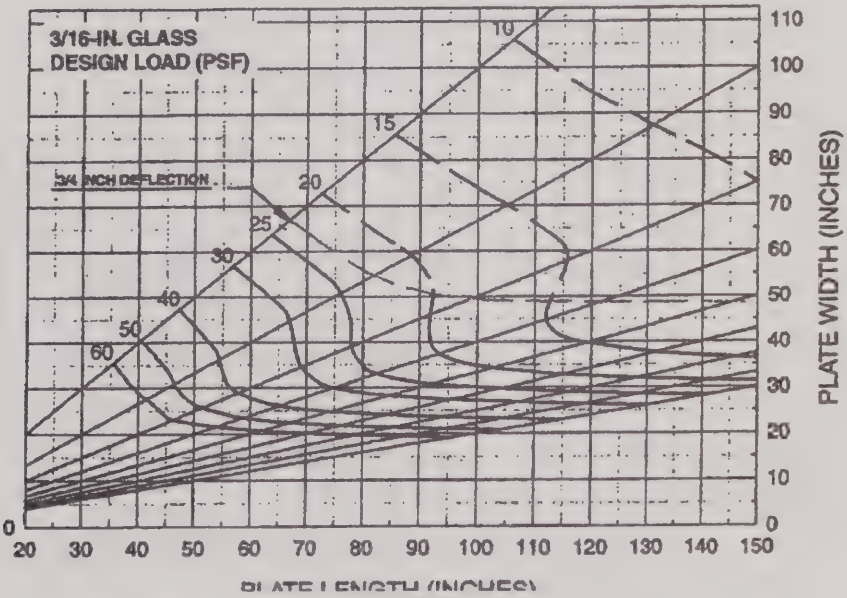
FIGURE 2404(4)[a, b, c, d, e, f] MAXIMUM ALLOWABLE LOAD FOR VERTICAL AND SLOPED RECTANGULAR GLASS SUPPORTED ON ALL EDGES



For SI: 1 inch = 25.4 mm, 1 pound per square foot - 0.0479 kPa.

a. In each graph, the vertical axis is the lesser dimension
b. The diagonal number on each graph shows the equivalent design load in psf/
c. The dashed lines indicate glass that has deflection in excess of ¾ inch.
d. Interpolation between lines is permitted, Extrapolation Is not allowed.
e. For laminated glass, the applicable glass thickness is the total glass thickness.
f. For insulating glass panes, the applicable glass thickness is the thickness of one pane.

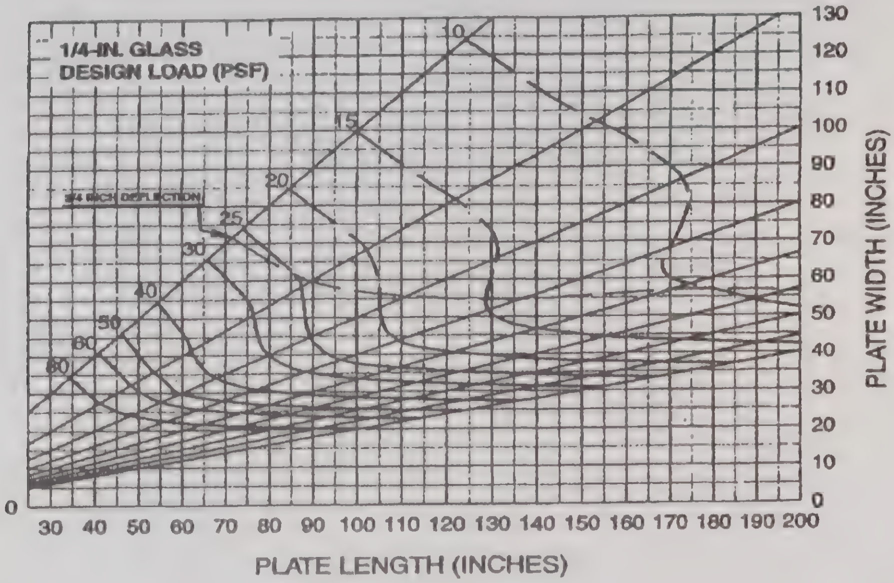
FIGURE 2404(5)[a, b, c, d, e, f] MAXIMUM ALLOWABLE LOAD FOR VERTICAL AND SLOPED RECTANGULAR GLASS SUPPORTED ON ALL EDGES



For SI: 1 inch = 25.4 mm, 1 pound per square foot - 0.0479 kPa.

a. In each graph, the vertical axis is the lesser dimension
b. The diagonal number on each graph shows the equivalent design load in psf/
c. The dashed lines indicate glass that has deflection in excess of ¾ inch.
d. Interpolation between lines is permitted, Extrapolation Is not allowed.
e. For laminated glass, the applicable glass thickness is the total glass thickness.
f. For insulating glass panes, the applicable glass thickness is the thickness of one pane.

FIGURE 2404(6)[a, b, c, d, e, f] MAXIMUM ALLOWABLE LOAD FOR VERTICAL AND SLOPED RECTANGULAR GLASS SUPPORTED ON ALL EDGES



For SI: 1 inch = 25.4 mm, 1 pound per square foot - 0.0479 kPa.

a. In each graph, the vertical axis is the lesser dimension

b. The diagonal number on each graph shows the equivalent design load in psf/

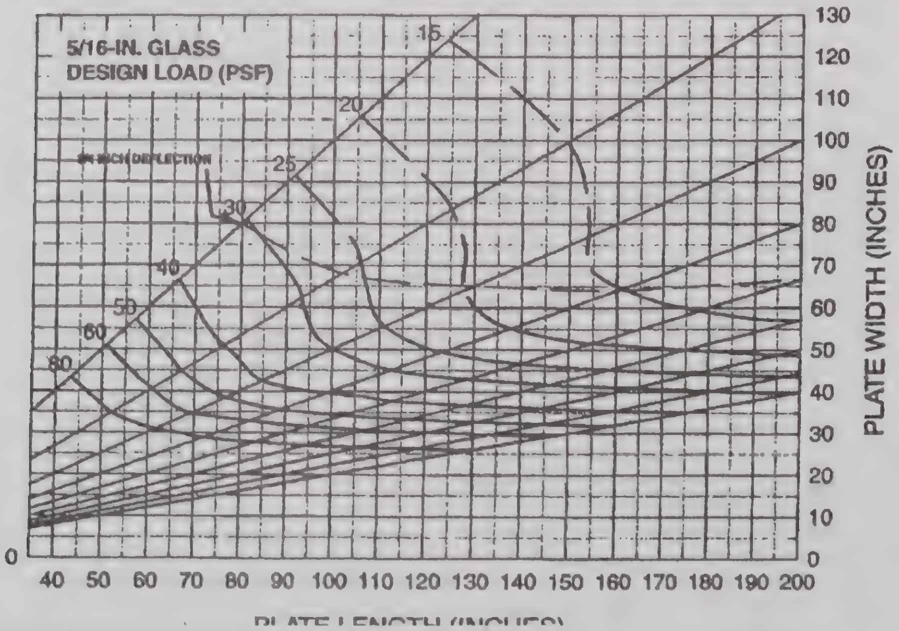
c. The dashed lines indicate glass that has deflection in excess of ¾ inch.

d. Interpolation between lines is permitted, Extrapolation Is not allowed.

e. For laminated glass, the applicable glass thickness is the total glass thickness.

f. For insulating glass panes, the applicable glass thickness is the thickness of one pane.

FIGURE 2404(7)[a, b, c, d, e, f] MAXIMUM ALLOWABLE LOAD FOR VERTICAL AND SLOPED RECTANGULAR GLASS SUPPORTED ON ALL EDGES



For SI: 1 inch = 25.4 mm, 1 pound per square foot - 0.0479 kPa.

a. In each graph, the vertical axis is the lesser dimension

b. The diagonal number on each graph shows the equivalent design load in psf/

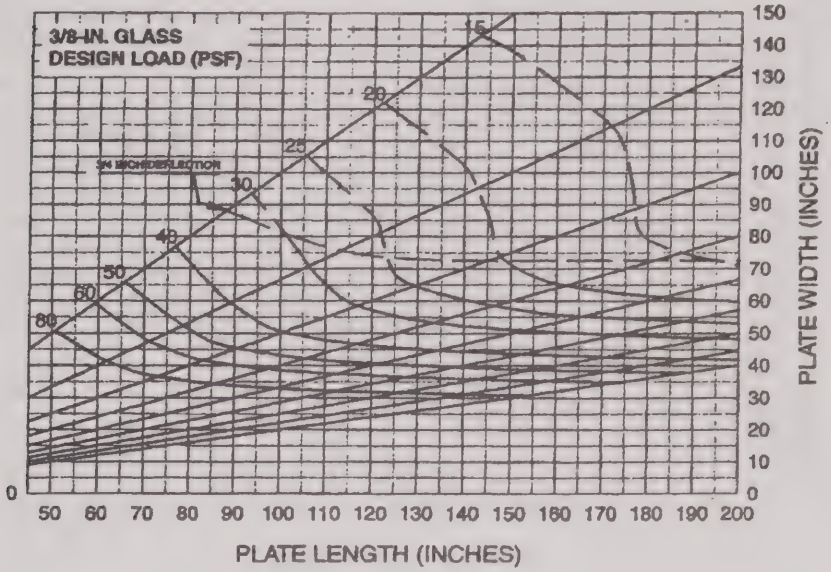
c. The dashed lines indicate glass that has deflection in excess of ¾ inch.

d. Interpolation between lines is permitted, Extrapolation Is not allowed.

e. For laminated glass, the applicable glass thickness is the total glass thickness.

f. For insulating glass panes, the applicable glass thickness is the thickness of one pane.

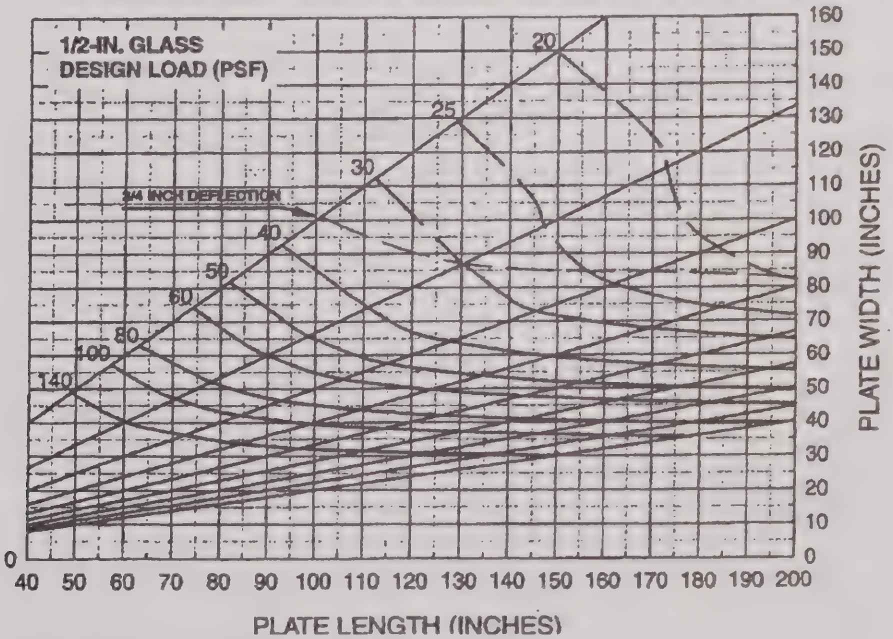
FIGURE 2404(8)[a, b, c, d, e, f] MAXIMUM ALLOWABLE LOAD FOR VERTICAL AND SLOPED RECTANGULAR GLASS SUPPORTED ON ALL EDGES



For SI: 1 inch = 25.4 mm, 1 pound per square foot - 0.0479 kPa.

a. In each graph, the vertical axis is the lesser dimension
b. The diagonal number on each graph shows the equivalent design load in psf/
c. The dashed lines indicate glass that has deflection in excess of ¾ inch.
d. Interpolation between lines is permitted, Extrapolation Is not allowed.
e. For laminated glass, the applicable glass thickness is the total glass thickness.
f. For insulating glass panes, the applicable glass thickness is the thickness of one pane.

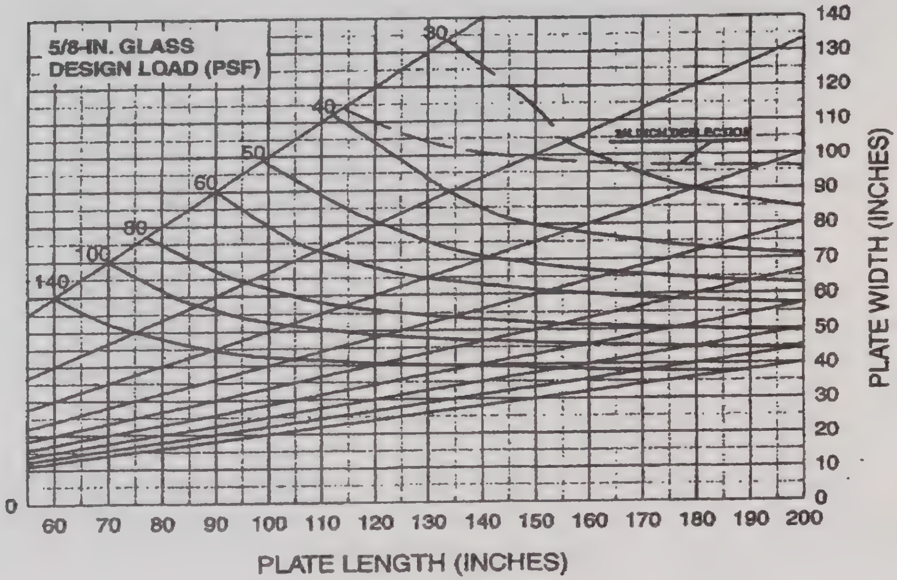
FIGURE 2404(9)[a, b, c, d, e, f] MAXIMUM ALLOWABLE LOAD FOR VERTICAL AND SLOPED RECTANGULAR GLASS SUPPORTED ON ALL EDGES



For SI: 1 inch = 25.4 mm, 1 pound per square foot - 0.0479 kPa.

a. In each graph, the vertical axis is the lesser dimension
b. The diagonal number on each graph shows the equivalent design load in psf/
c. The dashed lines indicate glass that has deflection in excess of ¾ inch.
d. Interpolation between lines is permitted, Extrapolation Is not allowed.
e. For laminated glass, the applicable glass thickness is the total glass thickness.
f. For insulating glass panes, the applicable glass thickness is the thickness of one pane.

FIGURE 2404(10)[a, b, c, d, e, f] MAXIMUM ALLOWABLE LOAD FOR VERTICAL AND SLOPED RECTANGULAR GLASS SUPPORTED ON ALL EDGES



For SI: 1 inch = 25.4 mm, 1 pound per square foot - 0.0479 kPa.

a. In each graph, the vertical axis is the lesser dimension

b. The diagonal number on each graph shows the equivalent design load in psf/

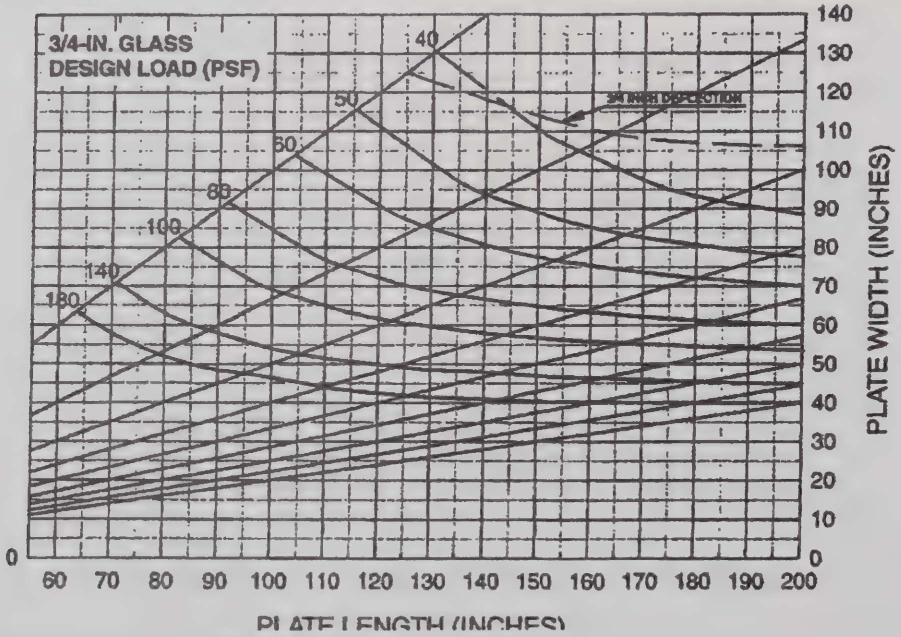
c. The dashed lines indicate glass that has deflection in excess of ¾ inch.

d. Interpolation between lines is permitted, Extrapolation Is not allowed.

e. For laminated glass, the applicable glass thickness is the total glass thickness.

f. For insulating glass panes, the applicable glass thickness is the thickness of one pane.

FIGURE 2404(11)[a, b, c, d, e, f] MAXIMUM ALLOWABLE LOAD FOR VERTICAL AND SLOPED RECTANGULAR GLASS SUPPORTED ON ALL EDGES



For SI: 1 inch = 25.4 mm, 1 pound per square foot - 0.0479 kPa.

a. In each graph, the vertical axis is the lesser dimension

b. The diagonal number on each graph shows the equivalent design load in psf/

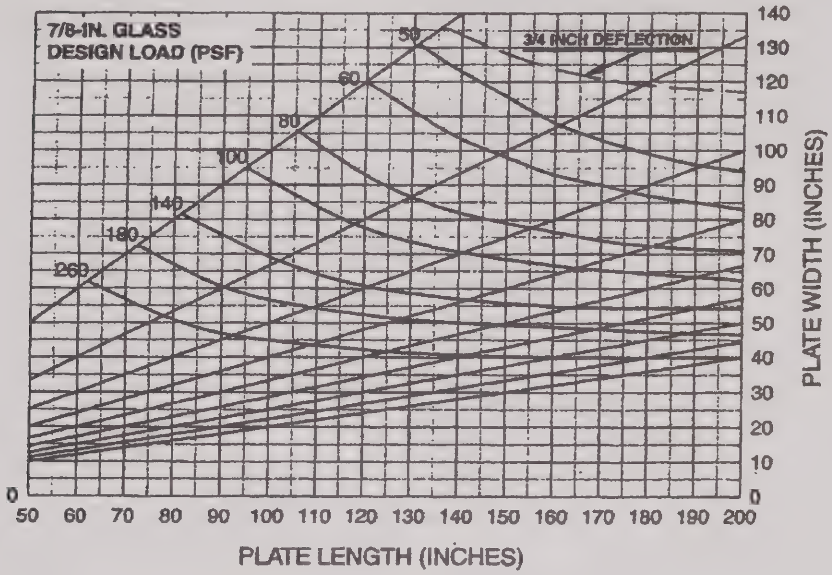
c. The dashed lines indicate glass that has deflection in excess of ¾ inch.

d. Interpolation between lines is permitted, Extrapolation Is not allowed.

e. For laminated glass, the applicable glass thickness is the total glass thickness.

f. For insulating glass panes, the applicable glass thickness is the thickness of one pane.

FIGURE 2404(12)[a, b, c, d, e, f] MAXIMUM ALLOWABLE LOAD FOR VERTICAL AND SLOPED RECTANGULAR GLASS SUPPORTED ON ALL EDGES



For SI: 1 inch = 25.4 mm, 1 pound per square foot - 0.0479 kPa.

a. In each graph, the vertical axis is the lesser dimension

b. The diagonal number on each graph shows the equivalent design load in psf/

c. The dashed lines indicate glass that has deflection in excess of ¾ inch.

d. Interpolation between lines is permitted, Extrapolation Is not allowed.

e. For laminated glass, the applicable glass thickness is the total glass thickness.

f. For insulating glass panes, the applicable glass thickness is the thickness of one pane.

780 CMR 2405.0 SLOPED GLAZING AND SKYLIGHTS

2405.1 Scope. 780 CMR 2405.0 applies to the installation of glass and other transparent, translucent or opaque glazing material installed at a slope more than 15 degrees (0.26 rad) from the vertical plane, including glazing materials in skylights, roofs and sloped walls.

2405.2 Allowable Glazing Materials and Limitations. Sloped glazing shall be any of the following materials, subject to the listed limitations.

1. For monolithic glazing systems, the glazing material of the single light or layer shall be laminated glass with a minimum 30-mil (0.76 mm) polyvinyl butyral (or equivalent) interlayer, wired glass, light-transmitting plastic materials meeting the requirements of 780 CMR 2607, heat-strengthened glass or fully tempered glass.
2. For multiple-layer glazing systems, each light or layer shall consist of any of the glazing materials specified in 780 CMR 2405.2, Item 1.

Annealed glass is permitted to be used as specified within 780 CMR 2405.3, Exceptions 2. and 3.

For additional requirements for plastic skylights, see 780 CMR 2610.0. Glass-block construction shall conform to the requirements of 780 CMR 2101.2.2.

2405.3 Screening. Where used in monolithic glazing systems, heat-strengthened glass and fully tempered glass shall have screens installed below the glazing material. The screens and their fastenings shall:

(a) be capable of supporting twice the weight of the glazing;

(b) be firmly and substantially fastened to the framing members and

(c) be installed within four inches (102 mm) of the glass.

The screens shall be constructed of a noncombustible material not thinner than No. 12 B&S gage (0.0808 inch) with mesh not larger than one inch by one inch (25 mm by 25 mm). In a corrosive atmosphere, structurally equivalent noncorrosive screen materials shall be used. Heat-strengthened glass, fully tempered glass and wired glass, when used in multiple-layer glazing systems as the bottom glass layer over the walking surface, shall be equipped with screening that conforms to the requirements for monolithic glazing systems.

Exception: In monolithic and multiple-layer sloped glazing systems, the following applies:

1. Fully tempered glass installed without protective screens where glazed between intervening floors at a slope of 30 degrees (0.52 rad) or less from the vertical plane shall have the highest point of the glass ten feet (3048 mm) or less above the walking surface.

2. Screens are not required below any glazing material, including annealed glass, where the walking surface below the glazing material is permanently protected from the risk of falling glass or the area below the glazing material is not a walking surface.

3. Any glazing material, including annealed glass, is permitted to be installed without screens in the sloped glazing systems of commercial or detached noncombustible greenhouses used exclusively for growing plants and not open to the public, provided that the height of the greenhouse at the ridge does not exceed 30 feet (9144 mm) above grade.

4. Screens shall not be required within individual dwelling units in Groups R-2, R-3 and R-4 as applicable in 780 CMR 101.2 where fully tempered glass is used as single glazing or as both panes in an insulating glass unit, and the following conditions are met: .

    4.1. Each pane of the glass is 16 square feet (1.5 m^2) or less in area.

    4.2. The highest point of the glass is 12 feet (3658 mm) or less above any walking surface or other accessible area.

    4.3. The glass thickness is $^3/_{16}$ inch (4.8 mm) or less.

5. Screens shall not be required for laminated glass with a 15-mil (0.38 mm) polyvinyl butyral (or equivalent) interlayer used within individual dwelling units in Groups R-2, R-3 and R-4 as applicable in 780 CMR 101.2 within the following limits:

    5.1. Each pane of glass is 16 square feet (1.5 m^2) or less in area.

    5.2. The highest point of the glass is 12 feet (3658 mm) or less above a walking surface or other accessible area.

2405.4 Framing. In Type 1 and 2 construction, sloped glazing and skylight frames shall be constructed of noncombustible materials. In structures where acid fumes deleterious to metal are incidental to the use of the buildings, approved pressure-treated wood or other approved non-corrosive materials are permitted to be used for sash and frames. Framing supporting sloped glazing and skylights shall be designed to resist the tributary roof loads in Chapter 16. Skylights set at an angle of less than 45 degrees (0.79 rad) from the horizontal plane shall be mounted at least four inches (102 mm) above the plane of the roof on a curb constructed as required for the frame. Skylights shall not be installed in the plane of the roof where the roof pitch is less than 45 degrees (0.79 rad) from the horizontal.

Exception. Installation of a skylight without a curb shall be permitted on roofs with a minimum slope of 14 degrees (three units vertical in 12 units horizontal) in Group R-3 occupancies as applicable in 780 CMR 101.2. All unit skylights installed in a roof with a pitch flatter than 14 degrees (0.25 rad) shall be mounted at least four inches (102 mm) above the plane of the roof on a curb constructed as required for the frame unless otherwise specified in the manufacturer's installation instructions.

2405.5 Unit Skylights. Unit skylights shall be tested and labeled as complying with *101/I.S.2/NAFS Voluntary Performance Specification for Windows, Skylights and Glass*. The label shall state the name of the manufacturer, the approved labeling agency, the product designation and the performance grade rating as specified in 101/I.S.2/NAFS. If the product manufacturer has chosen to have the performance grade of the skylight rated separately for positive and negative design pressure, then the label shall state both performance grade ratings as specified in 101/I.S.2/NAFS and the skylight shall comply with 780 CMR 2405.5.2. If the skylight is not rated separately for positive and negative pressure, then the performance grade rating shown on the label shall be the performance grade rating determined in accordance with 101/I.S.2/NAFS for both positive and negative design pressure, and the skylight shall conform to 780 CMR 2405.5.1.

2405.5.1 Unit Skylights Rated for the Same Performance Grade for Both Positive and Negative Design Pressure. The design of unit skylights shall be based on the following equation:

EQUATION 24-8

$$F_g \_ PG$$

where:

F_g is the maximum load on the skylight determined from Equations 24-3 through 24-5 in 780 CMR 2404.2.

PG is the performance grade rating of the skylight.

2405.5.2 Unit Skylights Rated for Separate Performance Grades for Positive and Negative Design Pressure. The design of unit skylights rated for performance grade for both positive and negative design pressures shall be based on the following equations:

EQUATION 24-9

$$F_{gi} \_ PGPos$$

EQUATION 24-10

$$F_{go} \_ PGNeg$$

where:

PG_{Pos} is the performance grade rating of the skylight under positive design pressure,

PG_{Neg} is the performance grade rating of the skylight under negative design pressure, and

F_{gi} and F_{go} are determined in accordance with the following:

If $W_O \_ D$, where W_o is the outward wind force, psf (kN/m^2) as calculated in 780 CMR 1609 and D is the dead weight of the glazing, psf (kN/m^2) as determined in 780 CMR 2404.2 for glass, or by the weight of the plastic, psf (kN/m^2) for plastic glazing.

F_{gi} is the maximum load on the skylight determined from Equations 24-4 and 24-5 in 780 CMR 2404.2,

F_{go} is the maximum load on the skylight determined from Equation 24-3.

If $W_O \ll D$, where W_o is the outward wind force, psf (kN/m^2) as calculated in 780 CMR 1609 and D is the dead weight of the glazing, psf (kN/m^2) as determined in 780 CMR 2404.2 for glass, or by the weight of the plastic for plastic glazing.

F_{gi} is the maximum load on the skylight determined from Equations 24-3 through 24-5 in 780 CMR 2404.2,

$F_{go} = 0$.

780 CMR 2406.0 SAFETY GLAZING

2406.1 Human Impact Loads. Individual glazed areas, including glass mirrors, in hazardous locations as defined in 780 CMR 2406.3 shall comply with 780 CMR 2406.1.1 through 2406.1.5.

2406.1.1 CPSC 16 CFR 1201. Except as provided in 780 CMR 2406.1.2 through 2406.1.5, all glazing shall pass the test requirements of CPSC 16 CFR 1201, listed in 780 CMR 35.00. Glazing shall comply with the CPSC 16 CFR, Part 1201 criteria, for Category I or II as indicated in Table 2406.1.

2406.1.2 Wired Glass. In other than Group E, wired glass installed in fire doors, fire windows and view panels in fire-resistant walls shall be permitted to comply with ANSI Z97.1.

2406.1.3 Plastic Glazing. Plastic glazing shall meet the weathering requirements of ANSI Z97.1.

2406.1.4 Glass Block. Glass-block walls shall comply with 780 CMR 2101.2.2.

2406.1.5 Louvered Windows and Jalousies. Louvered windows and jalousies shall comply with 780 CMR 2403.5.

2406.2 Identification of Safety Glazing. Except as indicated in 780 CMR 2406.1.2, each pane of safety glazing installed in hazardous locations shall be identified by a label specifying the labeler, whether the manufacturer or installer, and the safety glazing standard with which it complies, as well as the information specified in 780 CMR 2403.1. The label shall be acid etched, sand blasted, ceramic fired or an embossed mark, or shall be of a type that once applied cannot be removed without being destroyed.

Exceptions:

1. For other than tempered glass, labels are not required, provided the building official approves the use of a certificate, affidavit or other evidence confirming compliance with 780 CMR.
2. Tempered spandrel glass is permitted to be identified by the manufacturer with a removable paper label.

2406.2.1 Multilight Assemblies. Multilight glazed assemblies having individual lights not exceeding one square foot (0.09 square meter) in exposed area shall have at least one light in the assembly marked as indicated in 780 CMR 2406.2. Other lights in the assembly shall be marked "CPSC 16 CFR 1201" or "ANSI Z97.1," as appropriate.

TABLE 2406.1 MINIMUM CATEGORY CLASSIFICATION OF GLAZING

EXPOSED SURFACE AREA OF ONE SIDE OF ONE LITE	GLAZING IN STORM OR COMBINATION DOORS (Category class)	GLAZING IN DOORS (Category class)	GLAZED PANELS REGULATED BY 780 CMR 2406.3, ITEM 7. (Category class)	GLAZED PANELS REGULATED BY 780 CMR 2406.3, ITEM 6. (Category class)	DOORS AND ENCLOSURES REGULATED BY 780 CMR 2406.3, ITEM 5. (Category class)	SLIDING GLASS DOORS PATIO TYPE (Category class)
9 square feet or less	I	I	No requirement	I	II	II
More than 9 square feet	II	II	II	II	II	II

For SI: 1 square foot - 0.0929m^2

2406.3 Hazardous Locations. The following shall be considered specific hazardous locations requiring safety glazing materials:

1. Glazing in swinging doors except jalousies.
2. Glazing in fixed and sliding panels of sliding door assemblies and panels in sliding and bifold closet door assemblies.
3. Glazing in storm doors.
4. Glazing in unframed swinging doors.
5. Glazing in doors and enclosures for hot tubs, whirlpools, saunas, steam rooms, bathtubs and showers. Glazing in any portion of a building wall enclosing these compartments where the bottom exposed edge of the glazing is less than 60 inches (1524 mm) above a standing surface.
6. Glazing in an individual fixed or operable panel adjacent to a door where the nearest exposed edge of the glazing is within a 24-inch (610 mm) arc of either vertical edge of the door in a closed position and where the bottom exposed edge of the glazing is less than 60 inches (1524 mm) above the walking surface.

   Exceptions:

   1. Panels where there is an intervening wall or other permanent barrier between the door and glazing.
   2. Where access through the door is to a closet or storage area three feet (914 mm) or less in depth. Glazing in this application shall comply with 780 CMR 2406.3, Item 7.
   3. Glazing in walls perpendicular to the plane of the door in a closed position, other than the wall towards which the door swings when opened, in one- and two-family dwellings or within dwelling units in Group R-2.

7. Glazing in an individual fixed or operable panel, other than in those locations described in preceding Items 5 and 6, which meets all of the following conditions:

   7.1. Exposed area of an individual pane greater than nine square feet (0.84 m^2);

   7.2. Exposed bottom edge less than 18 inches (457 mm) above the floor;

   7.3. Exposed top edge greater than 36 inches (914 mm) above the floor; and

   7.4. One or more walking surface(s) within 36 inches (914 mm) horizontally of the plane of the glazing.

      Exception. Safety glazing for 780 CMR 2406.3, Item 7 is not required for the following installations:

      1. A protective bar $1^1/_2$ inches (38 mm) or more in height, capable of withstanding a horizontal load of 50 pounds plf (730 N/m) without contacting the glass, is installed on the accessible sides of the glazing 34 inches to 38 inches (864 mm to 965 mm) above the floor.
      2. The outboard pane in insulating glass units or multiple glazing where the bottom exposed edge of the glass is 25 feet (7620 mm) or more above any grade, roof, walking surface or other horizontal or sloped (within 45 degrees of horizontal) (0.78 rad) surface adjacent to the glass exterior.

8. Glazing in guards and railings, including structural baluster panels and nonstructural in-fill panels, regardless of area or height above a walking surface.
9. Glazing in walls and fences enclosing indoor and outdoor swimming pools, hot tubs and spas where all of the following conditions are present:

   9.1. The bottom edge of the glazing on the pool or spa side is less than 60 inches (1524 mm) above a walking surface on the pool or spa side of the glazing; and

   9.2. The glazing is within 60 inches (1524 mm) horizontally of the water's edge of a swimming pool or spa.

10. Glazing adjacent to stairways, landings and ramps within 36 inches (914 mm) horizontally of a walking surface; when the exposed surface of the glass is less than 60 inches (1524 mm) above the plane of the adjacent walking surface.
11. Glazing adjacent to stairways within 60 inches (1524 mm) horizontally of the bottom tread of a stairway in any direction when the exposed surface of the glass is less than 60 inches (1524 mm) above the nose of the tread.

    Exception. Safety glazing for 780 CMR 2406.3, Item 10. or 11. is not required for the following installations where:

    1. The side of a stairway, landing or ramp which has a guardrail or handrail, including balusters or in-fill panels, complying with the provisions of 780 CMR 1012 and 1607.7; and
    2. The plane of the glass is greater than 18 inches (457 mm) from the railing.

2406.3.1 Exceptions. The following products, materials and uses shall not be considered specific hazardous locations:

1. Openings in doors through which a three-inch (76 mm) sphere is unable to pass.
2. Decorative glass in 780 CMR 2406.3, Item 1., 6. or 7.
3. Glazing materials used as curved glazed panels in revolving doors.
4. Commercial refrigerated cabinet glazed doors.
5. Glass-block panels complying with 780 CMR 2101.2.2.
6. Louvered windows and jalousies complying with the requirements of 780 CMR 2403.5.
7. Mirrors and other glass panels mounted or hung on a surface that provides a continuous backing support.

2406.4 Fire Department Access Panels. Fire department glass access panels shall be of tempered glass. For insulating glass units, all panes shall be tempered glass.

780 CMR 2407.0 GLASS IN HANDRAILS AND GUARDS

2407.1 Materials. Glass used as structural balustrade panels in railings shall be constructed of either single fully tempered glass, laminated fully tempered glass or laminated heat-strengthened glass. Glazing in railing in-fill panels shall be of an approved safety glazing material that conforms to the provisions of 780 CMR 2406.1.1. For all glazing types, the minimum nominal thickness shall be ¼ inch (6.4 mm). Fully tempered glass and laminated glass shall comply with Category II of CPSC 16 CFR 1201, listed in 780 CMR 35.00.

2407.1.1 Loads. The panels and their support system shall be designed to withstand the loads specified in 780 CMR 1607.7. A safety factor of four shall be used.

2407.1.2 Support. Each handrail or guard section shall be supported by a minimum of three glass balusters or shall be otherwise supported to remain in place should one baluster panel fail. Glass balusters shall not be installed without an attached handrail or guard.

2407.1.3 Parking Garages. Glazing materials shall not be installed in railings in parking garages except for pedestrian areas not exposed to impact from vehicles.

780 CMR 2408.0 GLAZING IN ATHLETIC FACILITIES

2408.1 General. Glazing in athletic facilities and similar uses subject to impact loads, which forms whole or partial wall sections or which is used as a door or part of a door, shall comply with 780 CMR 2408.0.

2408.2 Racquetball and Squash Courts.

2408.2.1 Testing. Test methods and loads for individual glazed areas in racquetball and squash courts subject to impact loads shall conform to those of CPSC 16 CFR, Part 1201, listed in 780 CMR 35.00, with impacts being applied at a height of 59 inches (1499 mm) above the playing surface to an actual or simulated glass wall installation with fixtures, fittings and methods of assembly identical to those used in practice.

Glass walls shall comply with the following conditions:

1. A glass wall in a racquetball or squash court, or similar use subject to impact loads, shall remain intact following a test impact.
2. The deflection of such walls shall not be greater than 1½ inches (38 mm) at the point of impact for a drop height of 48 inches (1219 mm).

Glass doors shall comply with the following conditions:

1. Glass doors shall remain intact following a test impact at the prescribed height in the center of the door.
2. The relative deflection between the edge of a glass door and the adjacent wall shall not exceed the thickness of the wall plus ½ inch (12.7 mm) for a drop height of 48 inches (1219 mm).

2408.3 Gymnasiums and Basketball Courts. Glazing in multipurpose gymnasiums, basketball courts and similar athletic facilities subject to human impact loads shall comply with Category II of CPSC 16 CFR 1201, listed in 780 CMR 35.00.

780 CMR 2409.0 GLASS IN FLOORS AND SIDEWALKS

2409.1 General. Glass installed in the walking surface of floors, landings, stairwells and similar locations shall comply with 780 CMR 2409.2 through 2409.4.

2409.2 Design Load. The design for glass used in floors, landings, stair treads and similar locations shall be determined as indicated in 780 CMR 2409.4 based on the load that produces the greater stresses from the following:

1. The uniformly distributed unit load (F_u) from 780 CMR 1605.0;
2. The concentrated load (F_c) from Table 1607.1; or
3. The actual load (F_a) produced by the intended use.

The dead load (D) for glass in psf (kN/m^2) shall be taken as the total thickness of the glass plies in inches by 13 (For SI: glass plies in mm by 0.0245). Load reductions allowed by 780 CMR 1607.9 are not permitted.

2409.3 Laminated Glass. Laminated glass having a minimum of two plies shall be used. The glass shall be capable of supporting the total design load, as indicated in 780 CMR 2409.4, with any one ply broken

2409.4 Design Formula. Glass in floors and sidewalks shall be designed to resist the most critical of the following combinations of loads:

EQUATION 24-11

$$F_g = 2\,F_u + D$$

EQUATION 24-12

$$F_g = (8F_c/A) + D$$

EQUATION 24-13

$$F_g = F_a + D$$

where:

A = Area of rectangular glass, ft^2 (m^2).
D = Glass dead load (psf) = 13 t_g (for SI: 0.0245 t_g, kN/m^2).
t_g = Total glass thickness, inches (mm).
F_a = Actual intended use load, psf (kN/m^2).
F_c = Concentrated load, pounds (kN).
F_g = Total load, psf (kN/m^2) on glass.
F_u = Uniformly distributed load, psf (kN/m^2).

The design of the glazing shall be based on

EQUATION 24-14

$$F_g \_ F_{ga}$$

where F_g is the maximum load on the glass determined from the load combinations above, and F_{ga} is the maximum allowable load on the glass, computed by the following formula:

EQUATION 24-15

$$F_{ga} = 0.67\ c_2\ Fge$$

where:

F_{ge} = Maximum allowable equivalent load, psf (kN/m^2), determined from Figures 2404(1) through 2404(12) for the applicable glass dimensions and thickness; and
c_2 = Factor determined from Table 2404.2 based on glass type.

The factor, c_2, for laminated glass found in Table 2404.2 shall apply to two-ply laminates only. The value of F_a shall be doubled for dynamic applications.

780 CMR 25.00

GYPSUM BOARD AND PLASTER

780 CMR 2501.0 GENERAL

2501.1 Scope.

2501.1.1 General. Provisions of 780 CMR 25.00 shall govern the materials, design, construction and quality of gypsum board, lath, gypsum plaster and cement plaster.

2501.1.2 Performance. Lathing, plastering and gypsum board construction shall be done in the manner and with the materials specified in 780 CMR 25.00, and when required for fire protection, shall also comply with the provisions of 780 CMR 7.00.

2501.1.3 Other Materials. Other approved wall or ceiling coverings shall be permitted to be installed in accordance with the recommendations of the manufacturer and the conditions of approval.

780 CMR 2502.0 DEFINITIONS

2502.1 Definitions. The following words and terms shall, for the purposes of 780 CMR 25.00 and as used elsewhere in 780 CMR, have the meanings shown in 780 CMR 2502.1.

CEMENT PLASTER. A mixture of portland or blended cement, portland cement or blended cement and hydrated lime, masonry cement or plastic cement and aggregate and other approved materials as specified in 780 CMR.

EXTERIOR SURFACES. Weather-exposed surfaces.

GYPSUM BOARD. Gypsum wallboard, gypsum sheathing, gypsum base for gypsum veneer plaster, exterior gypsum soffit board, predecorated gypsum board or water-resistant gypsum backing board complying with the standards listed in Tables 2506.2, 2507.2 and 780 CMR 35.00.

GYPSUM PLASTER. A mixture of calcined gypsum or calcined gypsum and lime and aggregate and other approved materials as specified in 780 CMR.

GYPSUM VENEER PLASTER. Gypsum plaster applied to an approved base in one or more coats normally not exceeding ¼ inch (6.4 mm) in total thickness.

INTERIOR SURFACES. Surfaces other than weather-exposed surfaces.

WEATHER-EXPOSED SURFACES. Surfaces of walls, ceilings, floors, roofs, soffits and similar surfaces exposed to the weather except the following:

1. Ceilings and roof soffits enclosed by walls, fascia, bulkheads or beams that extend a minimum of 12 inches (305 mm) below such ceiling or roof soffits.
2. Walls or portions of walls beneath an unenclosed roof area, where located a horizontal distance from an open exterior opening equal to at least twice the height of the opening.
3. Ceiling and roof soffits located a minimum horizontal distance of ten feet (3048 mm) from the outer edges of the ceiling or roof soffits.

WIRE BACKING. Horizontal strands of tautened wire attached to surfaces of vertical supports which, when covered with the building paper, provide a backing for cement plaster.

780 CMR 2503.0 INSPECTION

2503.1 Inspection. Lath and gypsum board shall be inspected in accordance with 780 CMR 115.2: *Required Inspections*.

780 CMR 2504.0 VERTICAL AND HORIZONTAL ASSEMBLIES

2504.1 Scope. The following requirements shall be met where construction involves gypsum board, lath and plaster in vertical and horizontal assemblies.

2504.1.1 Wood Framing. Wood supports for lath or gypsum board, as well as wood stripping or furring, shall not be less than two inches (51 mm) nominal thickness in the least dimension.

Exception. The minimum nominal dimension of wood furring strips installed over solid backing shall not be less than one inch by two inches (25 mm by 51 mm).

2504.1.2 Studless Partitions. The minimum thickness of vertically erected studless solid plaster partitions of ⅜-inch (9.5 mm) and ¾-inch (19.1 mm) rib metal lath or ½-inch-thick (12.7 mm) long-length gypsum lath and gypsum board partitions shall be two inches (51 mm).

780 CMR 2505.0 SHEAR WALL CONSTRUCTION

2505.1 Resistance to Shear (Wood Framing). Wood-framed shear walls sheathed with gypsum board, lath and plaster shall be designed and constructed in accordance with 780 CMR 2306.4 and are permitted to resist wind and seismic loads. Walls resisting seismic loads shall be subject to the limitations in 780 CMR 16.00.

2505.2 Resistance to Shear (Steel Framing). Cold-formed steel framed shear walls sheathed with gypsum board and constructed in accordance with the materials and provisions of 780 CMR 2211.1, 2211.2, 2211.2.1 and 2211.2.2.3 are permitted to resist wind and seismic loads. Walls resisting seismic loads shall be subject to the limitations in 780 CMR 16.00.

780 CMR 2506.0 GYPSUM BOARD MATERIALS

2506.1 General. Gypsum board materials and accessories shall be identified by the manufacturer's designation to indicate compliance with the appropriate standards referenced in 780 CMR 2506.1 and stored to protect such materials from the weather.

2506.2 Standards. Gypsum board materials shall conform to the appropriate standards listed in Table 2506.2 and 780 CMR 35.00 and, where required for fire protection, shall conform to the provisions of 780 CMR 7.00.

TABLE 2506.2 GYPSUM BOARD MATERIALS AND ACCESSORIES

MATERIAL	STANDARD
Accessories for gypsum board	ASTM C 1047
Gypsum sheathing	ASTM C 79
Gypsum wallboard	ASTM C 36
Joint reinforcing tape and compound	ASTM C 474; C 475
Nails for gypsum boards	ASTM C 514, F 547, F 1667
Steel screws	ASTM C 954; C 1002
Steel studs, nonload bearing	ASTM C 645
Steel studs, load bearing	ASTM C 955
Water-resistant gypsum backing board	ASTM C 630
Exterior soffit board	ASTM C 931
Fiber-reinforced gypsum panels	ASTM C 1278
Gypsum backing board and gypsum shaftliner board	ASTM C 442
Gypsum ceiling board	ASTM C 1395
Standard specification for gypsum board	ASTM C 1396
Predecorated gypsum board	ASTM C 960
Adhesives for fastening gypsum wallboard	ASTM C 557
Testing gypsum and gypsum products	ASTM C 22; C 472; C 473
Glass mat gypsum substrate	ASTM C 1177
Glass mat gypsum backing panel	ASTM C 1178

780 CMR 2507.0 LATHING AND PLASTERING

2507.1 General. Lathing and plastering materials and accessories shall be marked by the manufacturer's designation to indicate compliance with the appropriate standards referenced in 780 CMR 2507.0 and stored in such a manner to protect them from the weather.

2507.2 Standards. Lathing and plastering materials shall conform to the standards listed in Table 2507.2 and 780 CMR 35.00 and, where required for fire protection, shall also conform to the provisions of 780 CMR 7.00.

TABLE 2507.2 LATH, PLASTERING MATERIALS AND ACCESSORIES

MATERIAL	STANDARD
Accessories for gypsum veneer base	ASTM C 1047
Exterior plaster bonding compounds	ASTM C 932
Gypsum base for veneer plasters	ASTM C 588
Gypsum casting and molding plaster	ASTM C 59
Gypsum Keene's cement	ASTM C 61
Gypsum lath	ASTM C 37
Gypsum plaster	ASTM C 28
Gypsum veneer plaster	ASTM C 587
Interior bonding compounds, gypsum	ASTM C 631
Lime plasters	ASTM C 5; C 206
Masonry cement	ASTM C 91
Metal lath	ASTM C 847
Plaster aggregates Sand Perlite Vermiculite	ASTM C 35; C 897 ASTM C 35 ASTM C 35
Plastic cement	ASTM C 1328
Blended cement	ASTM C 595
Portland cement	ASTM C 150
Steel studs and track	ASTM C 645; C 955
Steel screws	ASTM C 1002; C 954
Welded wire lath	ASTM C 933
Woven wire plaster base	ASTM C 1032

780 CMR 2508.0 GYPSUM CONSTRUCTION

2508.1 General. Gypsum board and gypsum plaster construction shall be of the materials listed in Tables 2506.2 and 2507.2. These materials shall be assembled and installed in compliance with the appropriate standards listed in Tables 2508.1 and 2511.1, and 780 CMR 35.

TABLE 2508.1 INSTALLATION OF GYPSUM CONSTRUCTION

MATERIAL	STANDARD
Gypsum sheathing	ASTM C 1280
Gypsum veneer base	ASTM C 844
Gypsum board	GA-216; ASTM C 840
Interior lathing and furring	ASTM C 841
Steel framing for gypsum boards	ASTM C 754; C 1007

2508.2 Limitations. Gypsum wallboard or gypsum plaster shall not be used in any exterior surface where such gypsum construction will be exposed directly to the weather. Gypsum wallboard shall not be used where there will be direct exposure to water or continuous high humidity conditions. Gypsum sheathing shall be installed on exterior surfaces in accordance with ASTM C 1280.

2508.2.1 Weather Protection. Gypsum wallboard, gypsum lath or gypsum plaster shall not be installed until weather protection for the installation is provided.

2508.3 Single-ply Application. Edges and ends of gypsum board shall occur on the framing members, except those edges and ends that are perpendicular to the framing members. Edges and ends of gypsum board shall be in moderate contact except in concealed spaces where fire-resistance-rated construction, shear resistance or diaphragm action is not required.

2508.3.1 Floating Angles. Fasteners at the top and bottom plates of vertical assemblies, or the edges and ends of horizontal assemblies perpendicular to supports, and at the wall line are permitted to be omitted except on shear resisting elements or fire-resistance-rated assemblies. Fasteners shall be applied in such a manner as not to fracture the face paper with the fastener head.

2508.4 Joint Treatment. Gypsum board fire-resistance-rated assemblies shall have joints and fasteners treated.

Exception. Joint and fastener treatment need not be provided where any of the following conditions occur:

1. Where the gypsum board is to receive a decorative finish such as wood paneling, battens, acoustical finishes or any similar application that would be equivalent to joint treatment.
2. On single-layer systems where joints occur over wood framing members.
3. Square edge or tongue-and-groove edge gypsum board (V-edge), gypsum backing board or gypsum sheathing.
4. On multilayer systems where the joints of adjacent layers are offset from one to another.
5. Assemblies tested without joint treatment.

2508.5 Horizontal Gypsum Board Diaphragm Ceilings. Gypsum board shall be permitted to be used on wood joists to create a horizontal diaphragm ceiling in accordance with Table 2508.5.

2508.5.1 Diaphragm Proportions. The maximum allowable diaphragm proportions shall be 1½:1 between shear resisting elements. Rotation or cantilever conditions shall not be permitted.

2508.5.2 Installation. Gypsum board used in a horizontal diaphragm ceiling shall be installed perpendicular to ceiling framing members. End joints of adjacent courses of gypsum board shall not occur on the same joist.

2508.5.3 Blocking of Perimeter Edges. All perimeter edges shall be blocked using a wood member not less than two-inch by six-inch (51 mm by 159 mm) nominal dimension. Blocking material shall be installed flat over the top plate of the wall to provide a nailing surface not less than two inches (51 mm) in width for the attachment of the gypsum board.

2508.5.4 Fasteners. Fasteners used for the attachment of gypsum board to a horizontal diaphragm ceiling shall be as defined in Table 2508.5. Fasteners shall be spaced not more than seven inches (178 mm) on center (o.c.) at all supports, including perimeter blocking, and not more than ⅜ inch (9.5 mm) from the edges and ends of the gypsum board.

2508.5.5 Lateral Force Restrictions. Gypsum board shall not be used in diaphragm ceilings to resist lateral forces imposed by masonry or concrete construction.

780 CMR 2509.0 GYPSUM BOARD IN SHOWERS AND WATER CLOSETS

2509.1 Wet Areas. Showers and public toilet walls shall conform to 780 CMR 1210.2 and 1210.3.

2509.2 Base for Tile. When gypsum board is used as a base for tile or wall panels for tubs, shower or water closet compartment walls, water-resistant gypsum backing board shall be used as a substrate. Regular gypsum wallboard is permitted under tile or wall panels in other wall and ceiling areas when installed in accordance with GA-216 or ASTM C 840.

TABLE 2508.5 SHEAR CAPACITY FOR HORIZONTAL WOOD FRAMED GYPSUM BOARD DIAPHRAGM CEILING ASSEMBLIES

MATERIAL	THICKNESS OF MATERIAL (MINIMUM) (inches)	SPACING OF FRAMING MEMBERS (MAXIMUM) (inches)	SHEAR VALUE[a,b] (plf of ceiling)	MIMIMUM FASTENER SIZE
Gypsum board	½	16 o.c.	90	5d cooler or wallboard nail; 1⅝-inch long; 0.086-inch shank; $^{15}/_{64}$ -inch head[c]
Gypsum board	½	24 o.c	70	5d cooler or wallboard nail; 1⅝-inch long; 0.086-inch shank; $^{15}/_{64}$ -inch head[c]

For SI: 1 inch = 25.4 mm, 1 plf = 14.6 N/m.

a. Values are not cumulative with other horizontal diaphragm values and are for short-term loading due to wind or seismic loading. Values shall be reduced 25% for normal loading.

b. Values shall be reduced 50% in Seismic Categories D, E and F.

c. 1¼-inch, No. 6 Type S or W screws are permitted to be substituted for the listed nails.

2509.3 Limitations. Water-resistant gypsum backing board shall not be used in the following locations:

1. Over a vapor retarder in shower or bathtub compartments.
2. Where there will be direct exposure to water or in areas subject to continuous high humidity.
3. On ceilings where frame spacing exceeds 12 inches (305 mm) o.c. for ½-inch-thick (12.7 mm) water-resistant gypsum backing board and more than 16 inches (406 mm) o.c. for ⅝-inch-thick (15.9 mm) water-resistant gypsum backing board.

780 CMR 2510.0 LATHING AND FURRING FOR CEMENT PLASTER (STUCCO)

2510.1 General. Exterior and interior cement plaster and lathing shall be done with the appropriate materials listed in Table 2507.2 and 780 CMR 35.00.

2510.2 Weather Protection. Materials shall be stored in such a manner as to protect such materials from the weather.

2510.3 Installation. Installation of these materials shall be in compliance with ASTM C 926 and ASTM C 1063.

2510.4 Corrosion Resistance. Metal lath and lath attachments shall be of corrosion-resistant material.

2510.5 Backing. Backing or a lath shall provide sufficient rigidity to permit plaster applications.

2510.5.1 Support of Lath. Where lath on vertical surfaces extends between rafters or other similar projecting members, solid backing shall be installed to provide support for lath and attachments.

2510.5.2 Use of Gypsum Backing Board.

2510.5.2.1 Use of Gypsum Board as a Backing Board. Gypsum lath or gypsum wallboard shall not be used as a backing for cement plaster.

Exception. Gypsum lath or gypsum wallboard is permitted, with a weather-resistant barrier, as a backing for self-furred metal lath or self-furred wire fabric lath and cement plaster where either of the following conditions occur:

1. On horizontal supports of ceilings or roof soffits.
2. On interior walls.

2510.5.2.2 Use of Gypsum Sheathing Backing. Gypsum sheathing is permitted as a backing for metal or wire fabric lath and cement plaster on walls. A weather-resistant barrier shall be provided in accordance with 780 CMR 2510.6.

2510.5.3 Backing Not Required. Wire backing is not required under expanded metal lath or paperbacked wire fabric lath.

2510.6 Weather-resistant Barriers. Weather-resistant barriers shall be installed as required in 780 CMR 1404.2 and, where applied over wood-based sheathing, shall include a weather-resistant vapor-permeable barrier with a performance at least equivalent to two layers of Grade D paper.

2510.7 Preparation of Masonry and Concrete. Surfaces shall be clean, free from efflorescence, sufficiently damp and rough for proper bond. If the surface is insufficiently rough, approved bonding agents or a portland cement dash bond coat mixed in proportions of not more than two parts volume of sand to one part volume of portland cement or plastic cement shall be applied. The dash bond coat shall be left undisturbed and shall be moist cured not less than 24 hours.

780 CMR 2511.0 INTERIOR PLASTER

2511.1 General. Plastering gypsum plaster or cement plaster shall not be less than three coats where applied over metal lath or wire fabric lath and not less than two coats where applied over other bases permitted by 780 CMR 25.00.

Exception. Gypsum veneer plaster and cement plaster specifically designed and approved for one-coat applications.

TABLE 2511.1 INSTALLATION OF PLASTER CONSTRUCTION

MATERIAL	STANDARD
Gypsum plaster	ASTM C 842
Gypsum veneer plaster	ASTM C 843
Interior lathing and furring (gypsum plaster)	ASTM C 841
Lathing and furring (cement plaster)	ASTM C 1063
Portland cement plaster	ASTM C 926
Steel framing	ASTM C 754; C 1007

2511.1.1 Installation. Installation of lathing and plaster materials shall conform with Table 2511.1 and 780 CMR 2507.0.

2511.2 Limitations. Plaster shall not be applied directly to fiber insulation board. Cement plaster shall not be applied directly to gypsum lath or gypsum plaster except as specified in 780 CMR 2510.5.1 and 2510.5.2.

2511.3 Grounds. Where installed, grounds shall ensure the minimum thickness of plaster as set forth in ASTM C 842 and ASTM C 926. Plaster thickness shall be measured from the face of lath and other bases.

2511.4 Interior Masonry or Concrete. Condition of surfaces shall be as specified in 780 CMR 2510.7. Approved specially prepared gypsum plaster designed for application to concrete surfaces or approved acoustical plaster is permitted. The total thickness of base coat plaster applied to concrete ceilings shall be as set forth in ASTM C 842 or

ASTM C 926. Should ceiling surfaces require more than the maximum thickness permitted in ASTM C 842 or ASTM C 926, metal lath or wire fabric lath shall be installed on such surfaces before plastering.

2511.5 Wet Areas. Showers and public toilet walls shall conform to 780 CMR1210.2 and 1210.3. When wood frame walls and partitions are covered on the interior with cement plaster or tile of similar material and are subject to water splash, the framing shall be protected with an approved moisture barrier.

780 CMR 2512.0 EXTERIOR PLASTER

2512.1 General. Plastering with cement plaster shall not be less than three coats where applied over metal lath or wire fabric lath and not less than two coats where applied over masonry, concrete or gypsum board backing as specified in 780 CMR 2510.5. If the plaster surface is to be completely covered by veneer or other facing material, or is completely concealed by another wall, plaster application need be only two coats, provided the total thickness is as set forth in ASTM C 926.

2512.1.1 On-grade Floor Slab. On wood framed or steel stud construction with an on-grade concrete floor slab system, exterior plaster shall be applied in such a manner as to cover, but not to extend below, the lath and paper. The application of lath, paper and flashing or drip screeds shall comply with ASTM C 1063.

2512.1.2 Weep Screeds. A minimum 0.019-inch (0.48 mm) (No. 26 galvanized sheet gage), corrosion-resistant weep screed with a minimum vertical attachment flange of 3½ inches (89 mm) shall be provided at or below the foundation plate line on exterior stud walls in accordance with ASTM C 926. The weep screed shall be placed a minimum of four inches (102 mm) above the earth or two inches (51 mm) above paved areas and be of a type that will allow trapped water to drain to the exterior of the building. The weather-resistant barrier shall lap the attachment flange. The exterior lath shall cover and terminate on the attachment flange of the weep screed.

2512.2 Plasticity Agents. Only approved plasticity agents and approved amounts thereof shall be added to portland cement. When plastic cement or masonry cement is used, no additional lime or plasticizers shall be added. Hydrated lime or the equivalent amount of lime putty used as a plasticizer is permitted to be added to cement plaster or cement and lime plaster in an amount not to exceed that set forth in ASTM C 926.

2512.3 Limitations. Gypsum plaster shall not be used on exterior surfaces.

2512.4 Cement Plaster. Plaster coats shall be protected from freezing for a period of not less than 24 hours after set has occurred. Plaster shall be applied when the ambient temperature is higher than 40°F (4°C), unless provisions are made to keep cement plaster work above 40°F (4°C) during application and 48 hours thereafter.

2512.5 Second-coat application. The second coat shall be brought out to proper thickness, rodded and floated sufficiently rough to provide adequate bond for the finish coat. The second coat shall have no variation greater than ¼ inch (6.4 mm) in any direction under a five-foot (1524 mm) straight edge.

2512.6 Curing and Interval. First and second coats of cement plaster shall be applied and moist cured as set forth in ASTM C 926 and Table 2512.6.

TABLE 2512.6 CEMENT PLASTERS

COAT	MINIMUM PERIOD MOIST CURING	MINIMUM INTERVAL BETWEEN COATS
First	48 hours[a]	48 hours[b]
Second	48 hours	7 days[c]
Finish	—	Note c

a. The first two coats shall be as required for the first coats of exterior plaster, except that the moist-curing time period between the first and second coats shall not be less than 24 hours. Moist curing shall not be required where job and weather conditions are favorable to the retention of moisture in the cement plaster for the required time period.

b. 24-hour minimum interval between coats of interior cement plaster. For alternate method of application, see 780 CMR 2512.8.

c. Finish coat plaster is permitted to be applied to interior portland cement base coats after a 48-hour period.

2512.7 Application to Solid Backings. Where applied over gypsum backing as specified in 780 CMR 2510.5 or directly to unit masonry surfaces, the second coat is permitted to be applied as soon as the first coat has attained sufficient hardness.

2512.8 Alternate Method of Application. The second coat is permitted to be applied as soon as the first coat has attained sufficiently rigidity to receive the second coat.

2512.8.1 Admixtures. When using this method of application, calcium aluminate cement up to 15 percent of the weight of the portland cement is permitted to be added to the mix.

2512.8.2 Curing. Curing of the first coat is permitted to be omitted and the second coat shall be cured as set forth in ASTM C 926 and Table 2512.6.

2512.9 Finish Coats. Cement plaster finish coats shall be applied over base coats that have been in place for the time periods set forth in ASTM C 926. The third or finish coat shall be applied with sufficient material and pressure to bond and to cover the brown coat and shall be of sufficient thickness to conceal the brown coat.

780 CMR 2513.0 EXPOSED AGGREGATE PLASTER

2513.1 General. Exposed natural or integrally colored aggregate is permitted to be partially embedded in a natural or colored bedding coat of cement plaster or gypsum plaster, subject to the provisions of 780 CMR 2513.0.

2513.2 Aggregate. The aggregate shall be applied manually or mechanically and shall consist of marble chips, pebbles or similar durable, moderately hard (three or more on the Mohs hardness scale), nonreactive materials.

2513.3 Bedding Coat Proportions. The bedding coat for interior or exterior surfaces shall be composed of one-part portland cement, one-part Type S lime and a maximum of three parts of graded white or natural sand by volume. The bedding coat for interior surfaces shall be composed of 100 pounds (45.4 kg) of neat gypsum plaster and a maximum of 200 pounds (90.8 kg) of graded white sand. A factory-prepared bedding coat for interior or exterior use is permitted. The bedding coat for exterior surfaces shall have a minimum compressive strength of 1,000 pounds per square inch (psi) (6895 kPa).

2513.4 Application. The bedding coat is permitted to be applied directly over the first (scratch) coat of plaster, provided the ultimate overall thickness is a minimum of ⅞ inch (22 mm), including lath. Over concrete or masonry surfaces, the overall thickness shall be a minimum of ½ inch (12.7 mm).

2513.5 Bases. Exposed aggregate plaster is permitted to be applied over concrete, masonry, cement plaster base coats or gypsum plaster base coats installed in accordance with 780 CMR 2511.0 or 25.012.

2513.6 Preparation of Masonry and Concrete. Masonry and concrete surfaces shall be prepared in accordance with the provisions of 780 CMR 2510.7.

2513.7 Curing of Base Coats. Cement plaster base coats shall be cured in accordance with ASTM C 926. Cement plaster bedding coats shall retain sufficient moisture for hydration (hardening) for 24 hours minimum or, where necessary, shall be kept damp for 24 hours by light water spraying.

780 CMR 26.00

PLASTIC

780 CMR 2601.0 GENERAL

2601.1 Scope. 780 CMR 26.00 shall govern the materials, design, application, construction and installation of foam plastic, foam plastic insulation, plastic veneer, interior plastic finish and trim and light-transmitting plastics. See 780 CMR 14.00 for requirements for exterior wall finish and trim.

> **Note: Requirements of 527 CMR 12.00: *Massachusetts Electrical Code* will also impact wiring/lighting requirements of 780 CMR 26.00.**

780 CMR 2602.0 DEFINITIONS

2602.1 General. The following words and terms shall, for the purposes of 780 CMR 26.00 and as used elsewhere in 780 CMR, have the meanings shown in 780 CMR 2602.1.

CELLULAR OR FOAMED PLASTIC. A heterogeneous system comprised of not less than two phases, one of which is a continuous polymeric organic material, and the second of which is deliberately introduced for the purpose of distributing gas in voids throughout the material.

Cellular or foamed plastic might contain foamed and unfoamed polymeric or monomeric precursors (prepolymer, if used), plasticizers, fillers, extenders, catalysts, blowing agents, colorants, stabilizers, lubricants, surfactants, pigments, reaction control agents, processing aids, and flame retardants.

Cellular or foamed plastic can be flexible or rigid and can be thermoplastic (melts and drips when exposed to heat or flame) or thermoset (chars when exposed to heat or flame).

Such plastic is intentionally expanded by the use of a foaming agent to produce a reduced-density plastic containing voids consisting of open or closed cells distributed throughout the plastic for thermal insulating or acoustical purposes and that has a density less than 20 pounds per cubic foot (pcf) (320 kg/m^3).

LIGHT-DIFFUSING SYSTEM. Construction consisting in whole or in part of lenses, panels, grids or baffles made with light-transmitting plastics positioned below independently mounted electrical light sources, skylights or light-transmitting plastic roof panels. Lenses, panels, grids and baffles that are part of an electrical fixture shall not be considered as a light-diffusing system.

LIGHT-TRANSMITTING PLASTIC ROOF PANELS. Structural plastic panels other than skylights that are fastened to structural members, or panels or sheathing and that are used as light-transmitting media in the plane of the roof.

LIGHT-TRANSMITTING PLASTIC WALL PANELS. Plastic materials that are fastened to structural members, or to structural panels or sheathing, and that are used as light-transmitting media in exterior walls.

PLASTIC, APPROVED. Any thermoplastic, thermosetting or reinforced thermosetting plastic material that conforms to combustibility classifications specified in the section applicable to the application and plastic type.

PLASTIC GLAZING. Plastic materials that are glazed or set in frame or sash and not held by mechanical fasteners that pass through the glazing material.

REINFORCED PLASTIC, GLASS FIBER. Plastic reinforced with glass fiber having not less than 20% of glass fibers by weight.

THERMOPLASTIC MATERIAL. A plastic material that is capable of being repeatedly softened by increase of temperature and hardened by decrease of temperature.

THERMOSETTING MATERIAL. A plastic material that is capable of being changed into a substantially nonreformable product when cured.

780 CMR 2603.0 FOAM PLASTIC INSULATION

2603.1 General. The provisions of 780 CMR 2603.0 shall govern the requirements and uses of foam plastic insulation in buildings and structures.

2603.2 Labeling and Identification. Packages and containers of foam plastic insulation and foam plastic insulation components delivered to the job site shall bear the label of an approved agency showing the manufacturer's name, the product listing, product identification and information sufficient to determine that the end use will comply with the code requirements.

2603.3 Surface-burning Characteristics. Unless otherwise indicated in 780 CMR 2603.3, foam plastic insulation and foam plastic cores of manufactured assemblies shall have a flame spread index of not more than 75 and a smoke-developed index of not more than 450 where tested in the maximum thickness intended for use in accordance with ASTM E 84. Loose fill-type foam plastic insulation shall be tested as board stock for the flame spread index and smoke-developed index.

Exceptions:

1. Smoke-developed index for interior trim as provided for in 780 CMR 2604.2.
2. In cold storage buildings, ice plants, food plants, food processing rooms and similar areas, foam plastic insulation where tested in a thickness of four inches (102 mm) shall be permitted in a thickness up to ten inches (254 mm) where the building is equipped throughout with an automatic fire sprinkler system in accordance with 780 CMR 903.3.1.1. The approved automatic sprinkler system shall be provided in both the room and that part of the building in which the room is located.
3. Foam plastic insulation that is a part of a Class A, B or C roof-covering assembly provided the assembly with the foam plastic insulation satisfactorily passes FM 4450 or UL 1256. The smoke-developed index shall not be limited for roof applications.
4. Foam plastic insulation greater than 4 inches (102 mm) in thickness shall have a maximum flame spread index of 75 and a smoke-developed index of 450 where tested at a minimum thickness of four inches (102 mm), provided the end use is approved in accordance with 780 CMR 2603.8 using the thickness and density intended for use.
5. Flame spread and smoke-developed indexes for foam plastic interior signs in covered mall buildings provided the signs comply with 780 CMR 402.14.

2603.4 Thermal Barrier. Except as provided for in 780 CMR 2603.4.1 and 2603.8, foam plastic shall be separated from the interior of a building by an approved thermal barrier of 0.5-inch (12.7 mm) gypsum wallboard or equivalent thermal barrier material that will limit the average temperature rise of the unexposed surface to not more than 250°F (120°C) after 15 minutes of fire exposure, complying with the standard time-temperature curve of ASTM E 119. The thermal barrier shall be installed in such a manner that it will remain in place for 15 minutes based on FM 4880, UL 1040, NFPA 286 or UL 1715. Combustible concealed spaces shall comply with 780 CMR 717.0.

2603.4.1 Thermal Barrier Not Required. The thermal barrier specified in 780 CMR 2603.4 is not required under the conditions set forth in 780 CMR 2603.4.1.1 through 2603.4.1.13.

2603.4.1.1 Masonry or Concrete Construction. In a masonry or concrete wall, floor or roof system where the foam plastic insulation is covered on each face by a minimum of one inch (25 mm) thickness of masonry or concrete.

2603.4.1.2 Cooler and Freezer Walls. Foam plastic installed in a maximum thickness of ten inches (254 mm) in cooler and freezer walls shall:

1. Have a flame spread index of 25 or less and a smoke-developed index of not more than 450, where tested in a minimum 4 inch (102 mm) thickness.
2. Have flash ignition and self-ignition temperatures of not less than 600°F and 800°F (316°C and 427°C), respectively.
3. Have a covering of not less than 0.032-inch (0.8 mm) aluminum or corrosion-resistant steel having a base metal thickness not less than 0.0160 inch (0.4 mm) at any point.
4. Be protected by an automatic sprinkler system. Where the cooler or freezer is within a building, both the cooler or freezer and that part of the building in which it is located shall be sprinklered.

2603.4.1.3 Walk-in Coolers. In nonsprinklered buildings, foam plastic having a thickness that does not exceed four inches (102 mm) and a maximum flame spread index of 75 is permitted in walk-in coolers or freezer units where the aggregate floor area does not exceed 400 square feet (37 m^2) and the foam plastic is covered by a metal facing not less than 0.032-inch-thick (0.81 mm) aluminum or corrosion-resistant steel having a minimum base metal thickness of 0.016 inch (0.41 mm). A thickness of up to ten inches (254 mm) is permitted where protected by a thermal barrier.

2603.4.1.4 Exterior Walls - One-story Buildings. For one-story buildings, foam plastic having a flame spread index of 25 or less, and a smoke-developed index of not more than 450, shall be permitted without thermal barriers in or on exterior walls in a thickness not more than four inches (102 mm) where the foam plastic is covered by a thickness of not less than 0.032-inch-thick (0.81 mm) aluminum or corrosion-resistant steel having a base metal thickness of 0.0160 inch (0.41 mm) and the building is equipped throughout with an automatic sprinkler system in accordance with 780 CMR 903.3.1.1.

2603.4.1.5 Roofing. Foam plastic insulation under a roof assembly or roof covering that is installed in accordance with the code and the manufacturer's instructions shall be separated from the interior of the building by wood structural panel sheathing not less than 0.47 inch (11.9 mm) in thickness bonded with exterior glue, with edges supported by blocking, tongue-and-groove joints or other approved type of edge support, or an equivalent material. A thermal barrier is not required for foam plastic insulation that is a part of a Class A, B or C roof-covering assembly, provided the assembly with the foam plastic insulation satisfactorily passes FM 4450 or UL 1256.

2603.4.1.6 Attics and Crawl Spaces. Within an attic or crawl space where entry is made only for service of utilities, foam plastic insulation shall be protected against ignition by 1.5-inch-thick (38 mm) mineral fiber insulation; 0.25-inch-thick (6.4 mm) wood structural panel, particleboard or hardboard; 0.375-inch (9.5 mm) gypsum wallboard, corrosion-resistant steel having a base metal thickness of 0.016 inch (0.4 mm) or other approved material installed in such a manner that the foam plastic insulation is not exposed. The protective covering shall be consistent with the requirements for the type of construction.

2603.4.1.7 Doors Not Required to Have a Fire Protection Rating. Where pivoted or side-hinged doors are permitted without a fire protection rating, foam plastic insulation, having a flame spread index of 75 or less and a smoke-developed index of not more than 450, shall be permitted as a core material where the door facing is of metal having a minimum thickness of 0.032-inch (0.8 mm) aluminum or steel having a base metal thickness of not less than 0.016 inch (0.4 mm) at any point.

2603.4.1.8 Exterior Doors in Buildings of Group R-2 or R-3. In occupancies classified as Group R-2 or R-3 as applicable in 780 CMR 3.00, foam-filled exterior entrance doors to individual dwelling units that do not require a fire-resistance rating shall be faced with wood or other approved materials.

2603.4.1.9 Garage Doors. Where garage doors are permitted without a fire-resistance rating and foam plastic is used as a core material, the door facing shall be metal having a minimum thickness of 0.032-inch (0.8 mm) aluminum or 0.010-inch (0.25 mm) steel or the facing shall be minimum 0.125-inch-thick (3.2 mm) wood. Garage doors having facings other than those described above shall be tested in accordance with, and meet the acceptance criteria of DASMA 107.

> **Exception**. Garage doors using foam plastic insulation complying with 780 CMR 2603.3 in detached and attached garages associated with one- and two-family dwellings need not be provided with a thermal barrier.

2603.4.1.10 Siding Backer Board. Foam plastic insulation of not more than 2,000 British thermal units per square feet (Btu/sq. ft.) (22.7 MJ/m^2) as determined by NFPA 259 shall be permitted as a siding backer board with a maximum thickness of 0.5 inch (12.7 mm), provided it is separated from the interior of the building by not less than two inches (51 mm) of mineral fiber insulation or equivalent or where applied as insulation with residing over existing wall construction.

2603.4.1.11 Interior Trim. Foam plastic used as interior trim in accordance with 780 CMR 2604.0 shall be permitted without a thermal barrier.

2603.4.1.12 Interior Signs. Foam plastic used for interior signs in covered mall buildings in accordance with 780 CMR 402.14 shall be permitted without a thermal barrier.

2603.4.1.13 Type V Construction. Foam plastic spray applied to a sill plate and header of Type V construction is subject to all of the following:

1. The maximum thickness of the foam plastic shall be 3¼ inches (82.6 mm).
2. The density of the foam plastic shall be in the range of 1.5 to 2.0 pcf (24 to 32 kg/m^3).
3. The foam plastic shall have a flame spread index of 25 or less and an accompanying smoke-developed index of 450 or less when tested in accordance with ASTM E84.

2603.5 Exterior Walls of Buildings of Any Height. Exterior walls of buildings of Type I, II, III or IV construction of any height shall comply with 780 CMR 2603.5.1 through 2603.5.7. Exterior walls of cold storage buildings required to be constructed of noncombustible materials, where the building is more than one story in height, shall also comply with the provisions of 780 CMR 2603.5.1 through 2603.5.7. Exterior walls of buildings of Type V construction shall comply with 780 CMR 2603.2, 2603.3 and 2603.4.

2603.5.1 Fire-resistance-rated Walls. Where the wall is required to have a fire-resistance rating, data based on tests conducted in accordance with ASTM E 119 shall be provided to substantiate that the fire-resistance rating is maintained.

2603.5.2 Thermal Barrier. Any foam plastic insulation shall be separated from the building interior by a thermal barrier meeting the provisions of 780 CMR 2603.4, unless special approval is obtained on the basis of 780 CMR 2603.8.

> **Exception**. One-story buildings complying with 780 CMR 2603.4.1.4.

2603.5.3 Potential Heat. The potential heat of foam plastic insulation in any portion of the wall or panel shall not exceed the potential heat expressed in Btu per square feet (mJ/m^2) of the foam plastic insulation contained in the wall assembly tested in accordance with 780 CMR 2603.5.5. The potential heat of the foam plastic insulation shall be determined by tests conducted in accordance with NFPA 259 and the results shall be expressed in Btu per square feet (mJ/m^2).

> **Exception**. One-story buildings complying with 780 CMR 2603.4.1.4.

2603.5.4 Flame Spread and Smoke-developed Indexes. Foam plastic insulation, exterior coatings and facings shall be tested separately in the thickness intended for use, but not to exceed four inches (102 mm), and shall each have a flame spread index of 25 or less and a smoke-developed index of 450 or less as determined in accordance with ASTM E 84.

> **Exception**. Prefabricated or factory-manufactured panels having minimum 0.020-inch (0.51 mm) aluminum facings and a total thickness of 0.25 inch (6.4 mm) or less are permitted to be tested as an assembly where the foam plastic core is not exposed in the course of construction.

2603.5.5 Test Standard. The wall assembly shall be tested in accordance with and comply with the acceptance criteria of NFPA 285.

> **Exception**. One-story buildings complying with 780 CMR 2603.4.1.4.

2603.5.6 Label Required. The edge or face of each piece of foam plastic insulation shall bear the label of an approved agency. The label shall contain the manufacturer's or distributor's identification, model number, serial number or definitive information describing the product or materials' performance characteristics and approved agency's identification.

2603.5.7 Ignition. Exterior walls shall not exhibit sustained flaming where tested in accordance with NFPA 268. Where a material is intended to be installed in more than one thickness, tests of the minimum and maximum thickness intended for use shall be performed.

> **Exception**. Assemblies protected on the outside with one of the following:
>
> 1. A thermal barrier complying with 780 CMR 2603.4.
> 2. A minimum one inch (25 mm) thickness of concrete or masonry.
> 3. Glass-fiber-reinforced concrete panels of a minimum thickness of 0.375 inch (9.5 mm).
> 4. Metal-faced panels having minimum 0.019- inch-thick (0.48 mm) aluminum or 0.016-inch- thick (0.41 mm) corrosion-resistant steel outer facings.
> 5. A minimum 0.875 inch (22.2 mm) thickness of stucco complying with 780 CMR 2510.

2603.6 Roofing. Foam plastic insulation meeting the requirements of 780 CMR 2603.2, 2603.3 and 2603.4 shall be permitted as part of a roof-covering assembly, provided the assembly with the foam plastic insulation is a Class A, B or C roofing assembly where tested in accordance with ASTM E 108 or UL 790.

2603.7 Plenums. Foam plastic insulation shall not be used as interior wall or ceiling finish in plenums except as permitted in 780 CMR 2604.0 or when protected by a thermal barrier in accordance with 780 CMR 2603.4.

2603.8 Special Approval. Foam plastic shall not be required to comply with the requirements of 780 CMR 2603.4 through 2603.7, where specifically approved based on large-scale tests such as, but not limited to, FM 4880, UL 1040, NFPA 286 or UL 1715. Such testing shall be related to the actual end-use configuration and be performed on the finished manufactured foam plastic assembly in the maximum thickness intended for use. Foam plastics that are used as interior finish on the basis of special tests shall also conform to the flame spread requirements of 780 CMR 8.00. Assemblies tested shall include seams, joints and other typical details used in the installation of the assembly and shall be tested in the manner intended for use.

780 CMR 2604.0 INTERIOR FINISH AND TRIM

2604.1 General. Plastic materials installed as interior finish or trim shall comply with 780 CMR 8.00. Foam plastics shall only be installed as interior finish where approved in accordance with the special provisions of 780 CMR 2603.8. Foam plastics that are used as interior finish shall also meet the flame spread index requirements for interior finish in accordance with 780 CMR 8.00. Foam plastics installed as interior trim shall comply with 780 CMR 2604.2.

> ***2604.1.1 Foam Plastics for Use in A-2 Occupancies. Foam plastics shall not be permitted in A-2 USE occupancies unless the room or space in which the foam plastics are installed is/are equipped with an automatic fire suppression system in accordance with 780 CMR 904.3.***

[F] 2604.2 Interior Trim. Foam plastic used as interior trim shall comply with 780 CMR 2604.2.1 through 2604.2.4.

> **[F] 2604.2.1 Density**. The minimum density of the interior trim shall be 20 pcf (320 kg/m^3).
>
> **[F] 2604.2.2 Thickness**. The maximum thickness of the interior trim shall be 0.5 inch (12.7 mm) and the maximum width shall be eight inches (204 mm).
>
> **[F] 2604.2.3 Area Limitation**. The interior trim shall not constitute more than 10% of the aggregate wall and ceiling area of any room or space.
>
> **[F] 2604.2.4 Flame Spread**. The flame spread index shall not exceed 75 where tested in accordance with ASTM E 84. The smoke-developed index shall not be limited.

780 CMR 2605.0 PLASTIC VENEER

2605.1 Interior Use. Where used within a building, plastic veneer shall comply with the interior finish requirements of 780 CMR 8.00.

> ***2605.1.1 Foam Plastics for Use in A-2 Occupancies. Foam plastics shall not be permitted in A-2 USE occupancies unless the room or space in which the foam plastics are installed is/are equipped with an automatic fire suppression system in accordance with 780 CMR 904.3.***

2605.2 Exterior Use. Exterior plastic veneer shall be permitted to be installed on the exterior walls of buildings of any type of construction in accordance with all of the following requirements:

1. Plastic veneer shall comply with 780 CMR 2606.4.
2. Plastic veneer shall not be attached to any exterior wall to a height greater than 50 feet (15 240 mm) above grade.
3. Sections of plastic veneer shall not exceed 300 square feet (27.9 m^2) in area and shall be separated by a minimum of 4 feet (1219 mm) vertically.

> **Exception**. The area and separation requirements and the smoke-density limitation are not applicable to plastic veneer applied to buildings constructed of Type VB construction, provided the walls are not required to have a fire-resistance rating.

780 CMR 2606.0 LIGHT-TRANSMITTING PLASTICS

2606.1 General. The provisions of 780 CMR 2606.0 and780 CMR 2607 through 2611 shall govern the quality and methods of application of light-transmitting plastics for use as light-transmitting materials in buildings and structures. Foam plastics shall comply with 780 CMR 2603. 0. Light-transmitting plastic materials that meet the other code requirements for walls and roofs shall be permitted to be used in accordance with the other applicable chapters of 780 CMR.

2606.2 Approval for Use. Sufficient technical data shall be submitted to substantiate the proposed use of any light-transmitting material, as approved by the building official and subject to the requirements of 780 CMR2606.0.

2606.3 Identification. Each unit or package of light-transmitting plastic shall be identified with a mark or decal satisfactory to the building official, which includes identification as to the material classification.

2606.4 Specifications. Light-transmitting plastics, including thermoplastic, thermosetting or reinforced thermosetting plastic material, shall have a self-ignition temperature of 650°F (343°C) or greater where tested in accordance with ASTM D 1929; a smoke-developed index not greater than 450 where tested in the manner intended for use in accordance with ASTM E 84, or not greater than 75 where tested in the thickness intended for use in accordance with ASTM D 2843 and shall conform to one of the following combustibility classifications:

> **Class CC1**. Plastic materials that have a burning extent of 1 inch (25 mm) or less where tested at a nominal thickness of 0.060 inch (1.5 mm), or in the thickness intended for use, in accordance with ASTM D 635,
> **Class CC2**. Plastic materials that have a burning rate of 2.5 inches per minute (1.06 mm/s) or less where tested at a nominal thickness of 0.060 inch (1.5 mm), or in the thickness intended for use, in accordance with ASTM D 635.

2606.5 Structural Requirements. Light-transmitting plastic materials in their assembly shall be of adequate strength and durability to withstand the loads indicated in 780 CMR 16.00. Technical data shall be submitted to establish stresses, maximum unsupported spans and such other information for the various thicknesses and forms used as deemed necessary by the building official.

2606.6 Fastening. Fastening shall be adequate to withstand the loads in 780 CMR 16.00. Proper allowance shall be made for expansion and contraction of light-transmitting plastic materials in accordance with accepted data on the coefficient of expansion of the material and other material in conjunction with which it is employed.

2606.7 Light-diffusing Systems. Unless the building is equipped throughout with an automatic sprinkler system in accordance with 780 CMR 903.3.1.1, light-diffusing systems shall not be installed in the following occupancies and locations:

1. Group A with an occupant load of 1,000 or more.
2. Theaters with a stage and proscenium opening and an occupant load of 700 or more.
3. Group I-2.
4. Group I-3.
5. Exit stairways and exit passageways.

> **2606.7.1 Support**. Light-transmitting plastic diffusers shall be supported directly or indirectly from ceiling or roof construction by use of noncombustible hangers. Hangers shall be at least No. 12 steel-wire gage (0.106 inch) galvanized wire or equivalent.

> **2606.7.2 Installation**. Light-transmitting plastic diffusers shall comply with 780 CMR 8.00 unless the light-transmitting plastic diffusers will fall from the mountings before igniting, at an ambient temperature of at least 200°F (93°C) below the ignition temperature of the panels. The panels shall remain in place at an ambient room temperature of 175°F (79°C) for a period of not

less than 15 minutes.

2606.7.3 Size Limitations. Individual panels or units shall not exceed ten feet (3048 mm) in length nor 30 square feet (2.79 m^2) in area.

2606.7.4 Fire Suppression System. In buildings that are equipped throughout with an automatic sprinkler system in accordance with 780 CMR 903.3.1.1, plastic light-diffusing systems shall be protected both above and below unless the sprinkler system has been specifically approved for installation only above the light-diffusing system. Areas of light-diffusing systems that are protected in accordance with 780 CMR 2606.7 shall not be limited.

2606.7.5 Electrical Lighting Fixtures. Light-transmitting plastic panels and light-diffuser panels that are installed in approved electrical lighting fixtures, **conforming to all applicable requirements of 527 CMR 12.00: *Massachusetts Electrical Code***, shall comply with the requirements of 780 CMR 8.00 unless the light-transmitting plastic panels conform to the requirements of 780 CMR 2606.7.2. The area of approved light-transmitting plastic materials that are used in required exits or corridors shall not exceed 30% of the aggregate area of the ceiling in which such panels are installed, unless the building is equipped throughout with an automatic sprinkler system in accordance with 780 CMR 903.3.1.1.

2606.8 Partitions. Light-transmitting plastics used in or as partitions shall comply with the requirements of 780 CMR 6.00 and 8.00.

2606.9 Bathroom Accessories. Light-transmitting plastics shall be permitted as glazing in shower stalls, shower doors, bathtub enclosures and similar accessory units. Safety glazing shall be provided in accordance with 780 CMR 24.00.

2606.10 Awnings, Patio Covers and Similar Structures. Awnings constructed of light-transmitting plastics shall be constructed in accordance with provisions specified in 780 CMR 3105 and 780 CMR 32.00 for projections and appendages. Patio covers constructed of light-transmitting plastics shall comply with 780 CMR 2606. Light-transmitting plastics used in canopies at motor fuel-dispensing facilities shall comply with 780 CMR 2606 except as modified by 780 CMR 406.5.2.

2606.11 Greenhouses. Light-transmitting plastics shall be permitted in lieu of plain glass in greenhouses.

2606.12 Solar Collectors. Light-transmitting plastic covers on solar collectors having noncombustible sides and bottoms shall be permitted on buildings not over three stories in height or 9,000 square feet (836.1 m^2) in total floor area, provided the light-transmitting plastic cover does not exceed 33.33% of the roof area for CC1 materials or 25% of the roof area for CC2 materials.

Exception. Light-transmitting plastic covers having a thickness of 0.010 inch (0.3 mm) or less or shall be permitted to be of any plastic material provided the area of the solar collectors does not exceed 33.33% of the roof area.

780 CMR 2607.0 LIGHT-TRANSMITTING PLASTIC WALL PANELS

2607.1 General. Light-transmitting plastics shall not be used as wall panels in exterior walls in occupancies in Groups A-l, A-2, H, I-2 and I-3. In other groups, light-transmitting plastics shall be permitted to be used as wall panels in exterior walls, provided that the walls are not required to have a fire-resistance rating and the installation conforms to the requirements of 780 CMR 2607.0. Such panels shall be erected and anchored on a foundation, waterproofed or otherwise protected from moisture absorption and sealed with a coat of mastic or other approved waterproof coating. Light-transmitting plastic wall panels shall also comply with 780 CMR 2606.0.

2607.2 Installation. Exterior wall panels installed as provided for in 780 CMR 2607.0 shall not alter the type of construction classification of the building.

2607.3 Height Limitation. Light-transmitting plastics shall not be installed more than 75 feet (22 860 mm) above grade plane, except as allowed by 780 CMR 2607.5.

2607.4 Area Limitation and Separation. The maximum area of a single wall panel and minimum vertical and horizontal separation requirements for exterior light-transmitting plastic wall panels shall be as provided for in Table 2607.4. The maximum percentage of wall area of any story in light-transmitting plastic wall panels shall not exceed that indicated in Table 2607.4 or the percentage of unprotected openings permitted by 780 CMR 704.8, whichever is smaller.

Exceptions:

1. In structures provided with approved flame barriers extending 30 inches (760 mm) beyond the exterior wall in the plane of the floor, a vertical separation is not required at the floor except that provided by the vertical thickness of the flame barrier projection.
2. Veneers of approved weather-resistant light-transmitting plastics used as exterior siding in buildings of Type V construction in compliance with 780 CMR 1406.
3. The area of light-transmitting plastic wall panels in exterior walls of greenhouses shall be exempt from the area limitations of Table 2607.4 but shall be limited as required for unprotected openings in accordance with 780 CMR 704.8.

TABLE 2607.4 AREA LIMITATION AND SEPARATION REQUIREMENTS FOR LIGHT-TRANSMITTING PLASTIC WALL PANELS

FIRE SEPARATION DISTANCE (feet)	CLASS OF PLASTIC	MAXIMUM PERCENTAGE AREA OF EXTERIOR WALL IN PLASTIC WALL PANELS	MAXIMUM SINGLE AREA OF PLASTIC WALL PANELS (square feet)	MINIMUM SEPARATION OF PLASTIC WALL PANELS (feet)	
				Vertical	Horizontal
Less than 6		Not Permitted	Not Permitted		
6 or more but less than 11	CC1	10	50	8	4
	CC2	Not Permitted	Not Permitted		
11 or more but less than or equal to 30	CC1	25	90	6	4
	CC2	15	70	8	4
Over 30	CC1	50	Not Limited	$_3$b	0
	CC2	50	100	$_6$b	3

For SI: 1 foot = 304.8 mm, 1 square foot = 0.0929 m^2.

a. For combinations of plastic glazing and plastic wall panel areas permitted, see 780 CMR 2607.6.

b. For reductions in vertical separation allowed, see 780 CMR 2607.4.

2607.5 Automatic Sprinkler System. Where the building is equipped throughout with an automatic sprinkler system in accordance with 780 CMR 903.3.1.1, the maximum percentage area of exterior wall in any story in light-transmitting plastic wall panels and the maximum square footage of a single area given in Table 2607.4 shall be increased 100%, but the area of light-transmitting plastic wall panels shall not exceed 50% of the wall area in any story, or the area permitted by 780 CMR 704.8 for unprotected openings, whichever is smaller. These installations shall be exempt from height limitations.

2607.6 Combinations of Glazing and Wall Panels. Combinations of light-transmitting plastic glazing and light-transmitting plastic wall panels shall be subject to the area, height and percentage limitations and the separation requirements applicable to the class of light-transmitting plastic as prescribed for light-transmitting plastic wall panel installations.

780 CMR 2608.0 LIGHT-TRANSMITTING PLASTIC GLAZING

2608.1 Buildings of Type VB Construction. Openings in the exterior walls of buildings of Type VB construction, where not required to be protected by 780 CMR 704.0, shall be permitted to be glazed or equipped with light-transmitting plastic. Light-transmitting plastic glazing shall also comply with 780 CMR 2606.

2608.2 Buildings of Other Types of Construction. Openings in the exterior walls of buildings of types of construction other than Type VB, where not required to be protected by 780 CMR 704.0, shall be permitted to be glazed or equipped with light-transmitting plastic in accordance with 780 CMR 2606.0 and all of the following:

1. The aggregate area of light-transmitting plastic glazing shall not exceed 25% of the area of any wall face of the story in which it is installed. The area of a single pane of glazing installed above the first story above grade plane shall not exceed 16 square feet (1.5 m^2) and the vertical dimension of a single pane shall not exceed four feet (1219 mm).

   Exception. Where an automatic sprinkler system is provided throughout in accordance with 780 CMR 903.3.1.1, the area of allowable glazing shall be increased to a maximum of 50% of the wall face of the story in which it is installed with no limit on the maximum dimension or area of a single pane of glazing.

2. Approved flame barriers extending 30 inches (762 mm) beyond the exterior wall in the plane of the floor, or vertical panels not less than four feet (1219 mm) in height, shall be installed between glazed units located in adjacent stories.

Exception. Buildings equipped throughout with an automatic sprinkler system in accordance with 780 CMR 903.3.1.1.

3. Light-transmitting plastics shall not be installed more than 75 feet (22 860 mm) above grade level.

   Exception. Buildings equipped throughout with an automatic sprinkler system in accordance with 780 CMR 903.3.1.1.

780 CMR 2609.0 LIGHT-TRANSMITTING PLASTIC ROOF PANELS

2609.1 General. Light-transmitting plastic roof panels shall comply with 780 CMR 2609.0 and 780 CMR 2606. Light-transmitting plastic roof panels shall not be installed in Groups H, I-2 and I-3. In all other groups, light-transmitting plastic roof panels shall comply with any one of the following conditions:

1. The building is equipped throughout with an automatic sprinkler system in accordance with 780 CMR 903.3.1.1.
2. The roof construction is not required to have a fire-resistance rating by Table 601.

3. The roof panels meet the requirements for roof coverings in accordance with 780 CMR 15.00.

2609.2 Separation. Individual roof panels shall be separated from each other by a distance of not less than four feet (1219 mm) measured in a horizontal plane.

Exceptions:
1. The separation between roof panels is not required in a building equipped throughout with an automatic sprinkler system in accordance with 780 CMR 903.3.1.1.
2. The separation between roof panels is not required in low-hazard occupancy buildings complying with the conditions of 780 CMR 2609.4, Exception 2. or 3.

2609.3 Location. Where exterior wall openings are required to be protected by 780 CMR 704.8, a roof panel shall not be installed within six feet (1829 mm) of such exterior wall.

2609.4 Area Limitations. Roof panels shall be limited in area and the aggregate area of panels shall be limited by a percentage of the floor area of the room or space sheltered in accordance with Table 2609.4.

Exceptions:
1. The area limitations of Table 2609.4 shall be permitted to be increased by 100% in buildings equipped throughout with an automatic sprinkler system in accordance with 780 CMR 903.3.1.1.
2. Low-hazard occupancy buildings, such as swimming pool shelters, shall be exempt from the area limitations of Table 2609.4, provided that the buildings do not exceed 5,000 square feet (465 m^2) in area and have a minimum fire separation distance of ten feet (3048 mm).
3. Greenhouses that are occupied for growing plants on a production or research basis, without public access, shall be exempt from the area limitations of Table 2609.4 provided they have a minimum fire separation distance of four feet (1220 mm).
4. Roof coverings over terraces and patios in occupancies in Group R-3 as applicable in 780 CMR 120.Z shall be exempt from the area limitations of Table 2609.4 and shall be permitted with light-transmitting plastics.

TABLE 2609.4 AREA LIMITATIONS FOR LIGHT-TRANSMITTING PLASTIC ROOF PANELS

CLASS OF PLASTIC	MAXIMUM AREA OF INDIVIDUAL ROOF PANELS (square feet)	MAXIMUM AGGREGATE AREA OF ROOF PANELS (percent of floor area)
CC1	300	30
CC2	100	25

For SI: 1 square foot = 0.0929 m^2.

780 CMR 2610.0 LIGHT-TRANSMITTING PLASTIC SKYLIGHT GLAZING

2610.1 Light-transmitting Plastic Glazing of Skylight Assemblies. Skylight assemblies glazed with light-transmitting plastic shall conform to the provisions of 780 CMR 2610.0 and 780 CMR 2606. Unit skylights glazed with light-transmitting plastic shall also comply with 780 CMR 2405.5.

Exception. Skylights in which the light-transmitting plastic conforms to the required roof-covering class in accordance with 780 CMR 1505.

2610.2 Mounting. The light-transmitting plastic shall be mounted above the plane of the roof on a curb constructed in accordance with the requirements for the type of construction classification, but at least four inches (102 mm) above the plane of the roof. Edges of light-transmitting plastic skylights or domes shall be protected by metal or other approved noncombustible material, or the light-transmitting plastic dome or skylight shall be shown to be able to resist ignition where exposed at the edge to a flame from a Class B brand as described in ASTM E 108 or UL 790.

Exceptions:
1. Curbs shall not be required for skylights used on roofs having a minimum slope of three units vertical in 12 units horizontal (25% slope) in occupancies in Group R-3 as applicable in 780 CMR 120.Z and on buildings with a nonclassified roof covering.
2. The metal or noncombustible edge material is not required where nonclassified roof coverings are permitted.

2610.3 Slope. Flat or corrugated light-transmitting plastic skylights shall slope at least four units vertical in 12 units horizontal (4:12). Dome-shaped skylights shall rise above the mounting flange a minimum distance equal to 10% of the maximum span of the dome but not less than three inches (76 mm).

Exception. Skylights that pass the Class B Burning Brand Test specified in ASTM E 108 or UL 790.

2610.4 Maximum Area of Skylights. Each skylight shall have a maximum area within the curb of 100 square feet (9.30 m^2).

Exception. The area limitation shall not apply where the building is equipped throughout with an automatic sprinkler system in accordance with 780 CMR 903.3.1.1 or the building is equipped with smoke and heat vents in accordance with 780 CMR 910.

2610.5 Aggregate Area of Skylights. The aggregate area of skylights shall not exceed 33⅓% of the floor area of the room or space sheltered by the roof in which such skylights are installed where Class CC1 materials are utilized, and 25% where

Class CC2 materials are utilized.

Exception. The aggregate area limitations of light-transmitting plastic skylights shall be increased 100% beyond the limitations set forth in 780 CMR 2610.5 where the building is equipped throughout with an automatic sprinkler system in accordance with 780 CMR 903.3.1.1 or the building is equipped with smoke and heat vents in accordance with 780 CMR 910.

2610.6 Separation. Skylights shall be separated from each other by a distance of not less than four feet (1219 mm) measured in a horizontal plane.

Exceptions:

1. Buildings equipped throughout with an automatic sprinkler system in accordance with 780 CMR 903.3.1.1.
2. In Group R-3 as applicable in 780 CMR 101.2, multiple skylights located above the same room or space with a combined area not exceeding the limits set forth in 780 CMR 2610.4.

2610.7 Location. Where exterior wall openings are required to be protected in accordance with 780 CMR 704.0, a skylight shall not be installed within six feet (1829 mm) of such exterior wall.

2610.8 Combinations of Roof Panels and Skylights. Combinations of light-transmitting plastic roof panels and skylights shall be subject to the area and percentage limitations and separation requirements applicable to roof panel installations.

780 CMR 2611.0 LIGHT-TRANSMITTING PLASTIC INTERIOR SIGNS

2611.1 General. Light-transmitting plastic interior wall signs shall be limited as specified in 780 CMR 2611.2 through 2611.4. Light-transmitting plastic interior wall signs in covered mall buildings shall comply with 780 CMR 402.14. Light-transmitting plastic interior signs shall also comply with 780 CMR 2606.

2611.2 Aggregate Area. The sign shall not exceed 20% of the wall area.

2611.3 Maximum Area. The sign shall not exceed 24 square feet (2.23 m^2).

2611.4 Encasement. Edges and backs of the sign shall be fully encased in metal.

NON-TEXT PAGE

ELECTRICAL

780 CMR 2701.0 GENERAL

2701.1 Scope. 780 CMR 27.00 governs the electrical components, equipment and systems used in buildings and structures covered by 780 CMR and includes specific requirements for when emergency or standby power is required. Electrical components, equipment and systems shall be designed and constructed in accordance with the applicable provisions of 527 CMR 12.00.

780 CMR 2702 EMERGENCY AND STANDBY POWER SYSTEMS

2702.1 Installation. Emergency and standby power systems shall be installed in accordance with 527 CMR 12.00, 527 CMR 27.00, NFPA 110 and NFPA 111.

2702.1.1 Stationary Generators. Emergency and standby power generators shall be listed in accordance with UL 2200 *(see 310 CMR 7.00 relative to air quality control regulations associated with point source generation).*

2702.2 Where Required. Emergency and standby power systems shall be provided where required by 780 CMR 2702.2.1 through 2702.2.19 (also see 780 CMR 914.3).

2702.2.1 Group A Occupancies. Emergency power shall be provided for voice communication systems in Group A occupancies in accordance with 780 CMR 907.2.1.1.

2702.2.2 Smoke Control Systems. Standby power shall be provided for smoke control systems in accordance with 780 CMR 909.11.

2702.2.3 Exit Signs. Emergency power shall be provided for exit signs in accordance with 780 CMR 1011.5.3.

2702.2.4 Means of Egress Illumination. Emergency power shall be provided for means of egress illumination in accordance with 780 CMR 1006.3.

2702.2.5 Accessible Means of Egress Elevators. Standby power shall be provided for elevators that are part of an accessible means of egress in accordance with 780 CMR 1007.4.

2702.2.6 Horizontal Sliding Doors. Standby power shall be provided for horizontal sliding doors in accordance with 780 CMR 1008.1.3.3.

2702.2.7 Semiconductor Fabrication Facilities. Emergency power shall be provided for semiconductor fabrication facilities in accordance with 780 CMR 415.9.10.

2702.2.8 Membrane Structures. Standby power shall be provided for auxiliary inflation systems in accordance with 780 CMR 3102.8.2. Emergency power shall be provided for exit signs in temporary tents and membrane structures in accordance with the 527 CMR.

2702.2.9 Hazardous Materials. Emergency or standby power shall be provided in occupancies with hazardous materials in accordance with 780 CMR 414.5.4.

2702.2.10 Highly Toxic and Toxic Materials. Emergency power shall be provided for occupancies with highly toxic or toxic materials in accordance with 527 CMR.

2702.2.11 Organic Peroxides. Standby power shall be provided for occupancies with silane gas in accordance with 527 CMR.

2702.2.12 Pyrophoric Materials. Emergency power shall be provided for occupancies with silane gas in accordance with 527 CMR.

2702.2.13 Covered Mall Buildings. Standby power shall be provided for voice/alarm communication systems in covered mall buildings in accordance with 780 CMR 402.12.

2702.2.14 High-rise Buildings. Emergency and standby power shall be provided in high-rise buildings in accordance with 780 CMR 403.10 and 780 CMR 403.11.

2702.2.15 Underground Buildings. Emergency and standby power shall be provided in underground buildings in accordance with 780 CMR 405.9 and 780 CMR 405.10.

2702.2.16 Group I-3 Occupancies. Emergency power shall be provided for doors in Group I-3 occupancies in accordance with 780 CMR 408.4.2.

2702.2.17 Airport Traffic Control Towers. Standby power shall be provided in airport traffic control towers in accordance with 780 CMR 412.1.5.

2702.2.18 Elevators. Standby power for elevators shall be provided as set forth in 524 CMR.

2702.2.19 Smokeproof Enclosures. Standby power shall be provided for smokeproof enclosures as required by 780 CMR 909.20.

2702.3 Maintenance. Emergency and standby power systems shall be maintained and tested in accordance with 527 CMR.

NON-TEXT PAGE

MECHANICAL SYSTEMS

780 CMR 2801.0 GENERAL

2801.1 Scope. Mechanical appliances, equipment and systems shall be constructed, installed and maintained in accordance with the *International Mechanical Code*. Masonry chimneys, fireplaces and barbecues shall comply with the *International Mechanical Code* and 780 CMR 21.00.

> ***Note: Where legal jurisdiction for the listing, design, installation, maintenance, alteration and/or inspection of mechanical systems is controlled by one or more of the Massachusetts Specialized codes (see 780 CMR 101.5), including, but not limited to, 248 CMR and 527 CMR, the requirements of such Massachusetts Specialized Code(s) shall apply and the requirements of 780 CMR 1.00 through 49.00 shall not apply (refer to 780 CMR 35.00: Referenced Standards for a list of the Massachusetts Specialized Codes).***

NON-TEXT PAGE

780 CMR 29.00

PLUMBING SYSTEMS

780 CMR 2901.0 GENERAL

Note: In Massachusetts, refer to 248 CMR, the Fuel Gas and Plumbing Code

NON-TEXT PAGE

ELEVATORS AND CONVEYING SYSTEMS

780 CMR 3001.0 GENERAL

Note 1. The Massachusetts Elevator Code is 524 CMR.

Note 2. For Accessibility Requirements for elevators, refer to 521 CMR.

780 CMR 3002.0 HOISTWAY ENCLOSURES

3002.1 Hoistway Enclosure Protection. Elevator, dumbwaiter and other hoistway enclosures shall have a fire-resistance rating not less than that specified in 780 CMR 6.00 and shall be constructed in accordance with 780 CMR 7.00.

3002.1.1 Opening Protectives. Openings in hoistway enclosures shall be protected as required in 780 CMR 7.00.

3002.1.2 Hardware. Hardware on opening protectives shall be of an approved type installed as tested, except that approved interlocks, mechanical locks and electric contacts, door and gate electric contacts and door-operating mechanisms shall be exempt from the fire test requirements.

3002.2 Number of Elevator Cars in a Hoistway. See 524 CMR

3002.3 Emergency Signs. An approved pictorial sign of a standardized design shall be posted adjacent to each elevator call station on all floors instructing occupants to use the exit stairways and not to use the elevators in case of fire. The sign shall read: IN FIRE EMERGENCY, DO NOT USE ELEVATOR. USE EXIT STAIRS. The emergency sign shall not be required for elevators that are part of an accessible means of egress complying with 780 CMR 1007.4.

780 CMR 3003.0 MACHINE ROOMS

3003.1 Pressurization. The elevator machine room serving a pressurized elevator hoistway shall be pressurized upon activation of a heat or smoke detector located in the elevator machine room.

3003.2 Machine Rooms and Machinery Spaces. Elevator machine rooms and machinery spaces shall be enclosed with construction having a fire-resistance rating not less than the required rating of the hoistway enclosure served by the machinery (See 780 CMR 3002.1). Openings shall be protected with assemblies having a fire-resistance rating not less than that required for the hoistway enclosure doors.

NON-TEXT PAGE

SPECIAL CONSTRUCTION

780 CMR 3101.0 GENERAL

3101.1 Scope. The provisions of 780 CMR 31.00 shall govern special building construction including membrane structures, temporary structures, pedestrian walkways and tunnels, awnings and canopies, marquees, signs, and towers and antennas; *portions of 780 CMR 31.00 may reference either the International Fire Code (IFC) or the International Mechanical Code therefore also see 780 CMR 3101.2 and 3101.3.*

3101.2 The ICC International Fire Code (IFC), the ICC International Mechanical Code (IMC) and the Specific Specialized Code - The Board of Fire Prevention Regulations (527 CMR). 780 CMR contains design and construction requirements for all USE Group buildings and their building permittable systems and also references additional applicable design and construction requirements of the IFC and the IMC for the various USE Groups and industrial processes within such USE Groups, including H-USES. It is the intention in referencing the IFC and the IMC that only the IFC and IMC requirements narrow to Building Code matters; i.e., USE Group classification, general building limitations of height and area, fireresistant materials and construction, interior finishes, required fire protection systems (otherwise not specifically regulated by 527 CMR), means of egress, interior environment, energy conservation, exterior wall coverings, roof and roof coverings, structural loads, structural tests and inspections, foundations and retaining walls, construction materials, glass and glazing, plastics, mechanical systems, special construction, site work, demolition and construction in the public right-of-way, building permittable work in existing buildings and control of manufactured buildings and manufactured components, etc., as historically addressed in 780 CMR: the Massachusetts State Building Code are intended regulated by 780 CMR.

> *Exception: The design and construction requirements of bunkers and magazines for the storage of explosive materials, flammable/ combustible liquids and chemical process safety, shall default to the specific requirements of 527 CMR and are not enforceable by Building Officials but rather by the Head of the Fire Department or his/her designee.*
>
> *Note that the IFC and the IMC are not only building and building permittable systems design and construction documents but also include fire prevention requirements and the fire prevention requirements of the IFC and IMC are not requirements regulated by 780 CMR nor enforceable by Building Officials / For fire prevention requirements do not refer to the IFC or IMC but rather to 527 CMR, the Massachusetts Board of Fire Prevention Regulations. If there is conflict between 780 CMR and 527 CMR, the more stringent standard shall apply.*

3101.3 The ICC International Fire Code (IFC), the ICC International Mechanical Code (IMC) and the Family of Massachusetts Specialized Codes (refer to 780 CMR, 101.5). 780 CMR contains design and construction requirements for all USE Group buildings and their building permittable systems and also references additional applicable design and construction requirements of the IFC and the IMC for the various USE Groups and industrial processes within such USE Groups, including H-USES. It is the intention in referencing the IFC and the IMC that only the IFC and IMC requirements narrow to Building Code matters (see 780 CMR 3101.11 are regulated by 780 CMR. Where the IFC and IMC reference requirements related to: architectural access; environmental protection; electrical; elevator; fire prevention (otherwise not specifically regulated by 527 CMR); gas; or sanitary code requirements, such requirements are not regulated by 780 CMR nor enforceable by Building Officials (Building Officials do enforce architectural access requirements set forth in 521 CMR) / For Specialized Code requirements do not refer to the IFC or IMC but rather to the appropriate Specialized Code requirements of Massachusetts (refer to 780 CMR 101.5).

780 CMR 3102.0 MEMBRANE STRUCTURES

3102.1 General. The provisions of 780 CMR 3102.0 shall apply to air-supported, air-inflated, membrane-covered cable and membrane-covered frame structures, collectively known as membrane structures, erected for a period of 180 days or longer. Those erected for a shorter period of time shall comply with the requirements of *the International Fire Code (IFC)*. Membrane structures covering water storage facilities, water clarifiers, water treatment plants, sewage treatment plants, greenhouses and similar facilities not used for human occupancy, are required to meet only the requirements of 780 CMR 3102.3.1 and 3102.7.

3102.2 Definitions. The following words and terms shall, for the purposes of this section and as used elsewhere in 780 CMR, have the meanings shown in 780 CMR 3102.2:

AIR-INFLATED STRUCTURE. A building where the shape of the structure is maintained by air pressurization of cells or tubes to form a barrel vault over the usable area. Occupants of such a structure do not occupy the pressurized area used to support the structure.

AIR-SUPPORTED STRUCTURE. A building wherein the shape of the structure is attained by air pressure and occupants of the structure are within the elevated pressure area. Air-supported structures are of two basic types:

Double Skin. Similar to a single skin, but with an attached liner that is separated from the outer skin and provides an airspace which serves for insulation, acoustic, aesthetic or similar purposes.

Single Skin. Where there is only the single outer skin and the air pressure is directly against that skin.

CABLE-RESTRAINED, AIR-SUPPORTED STRUCTURE. A structure in which the uplift is resisted by cables or webbings which are anchored to either foundations or dead men. Reinforcing cable or webbing is attached by various methods to the membrane or is an integral part of the membrane. This is not a cable-supported structure.

MEMBRANE-COVERED CABLE STRUCTURE. A nonpressurized structure in which a mast and cable system provides support and tension to the membrane weather barrier and the membrane imparts stability to the structure.

MEMBRANE-COVERED FRAME STRUCTURE. A nonpressurized building wherein the structure is composed of a rigid framework to support a tensioned membrane which provides the weather barrier.

NONCOMBUSTIBLE MEMBRANE STRUCTURE. A membrane structure in which the membrane and all component parts of the structure are noncombustible.

3102.3 Type of Construction. Noncombustible membrane structures shall be classified as Type IIB construction. Noncombustible frame or cable-supported structures covered by an approved membrane in accordance with 780 CMR 3102.3.1 shall be classified as Type IIB construction. Heavy timber frame-supported structures covered by an approved membrane in accordance with Section 3102.3.1 shall be classified as Type IV construction. Other membrane structures shall be classified as Type V construction.

Exception. Plastic less than 30 feet (9144 mm) above any floor used in greenhouses, where occupancy by the general public is not authorized, and for aquaculture pond covers, is not required to be flame resistant.

3102.3.1 Membrane and Interior Liner Material. Membranes and interior liners shall be either noncombustible as set forth in 780 CMR 703.4, or flame resistant as determined in accordance with NFPA 701 and the manufacturer's test protocol.

Exception. Plastic less than 20 mil (500 mm) in thickness used in greenhouses, where occupancy by the general public is not authorized, and for aquaculture pond covers, is not required to be flame resistant.

3102.4 Allowable Floor Areas. The area of a membrane structure shall not exceed the limitations set forth in Table 503, except as provided in 780 CMR 506.0.

3102.5 Maximum Height. Membrane structures shall not exceed one story nor shall such structures exceed the height limitations in feet set forth in Table 503.

Exception. Noncombustible membrane structures serving as roofs only.

3102.6 Mixed Construction. Membrane structures shall be permitted to be utilized as specified in this section as a portion of buildings of other types of construction. Height and area limits shall be as specified for the type of construction and occupancy of the building.

3102.6.1 Noncombustible Membrane. A noncombustible membrane shall be permitted for use as the roof or as a skylight of any building or atrium of a building of any type of construction provided it is at least 20 feet (6096 mm) above any floor, balcony or gallery.

3102.6.1.1 Flame-resistant Membrane. A flame-resistant membrane shall be permitted to be used as the roof or as a skylight on buildings of Type IIB, III, IV and V construction provided it is at least 20 feet (6096 mm) above any floor, balcony or gallery.

3102.7 Engineering Design. The structure shall be designed and constructed to sustain dead loads; loads due to tension or inflation; live loads including wind, snow or flood and seismic loads and in accordance with 780 CMR 16.00.

3102.8 Inflation Systems. Air-supported and air-inflated structures shall be provided with primary and auxiliary inflation systems to meet the minimum requirements of 780 CMR 3102.8.1 through 3102.8.3.

3102.8.1 Equipment Requirements. This inflation system shall consist of one or more blowers and shall include provisions for automatic control to maintain the required inflation pressures. The system shall be so designed as to prevent overpressurization of the system.

3102.8.1.1 Auxiliary Inflation System. In addition to the primary inflation system, in buildings exceeding 1,500 square feet (140 m^2) in area, an auxiliary inflation system shall be provided with sufficient capacity to maintain the inflation of the structure in case of primary system failure. The auxiliary inflation system shall operate automatically when there is a loss of internal pressure and when the primary blower system becomes inoperative.

3102.8.1.2 Blower Equipment. Blower equipment shall meet the following requirements:

1. Blowers shall be powered by continuous-rated motors at the maximum power required for any flow condition as required by the structural design.
2. Blowers shall be provided with inlet screens, belt guards and other protective devices as required by the building official to provide protection from injury.
3. Blowers shall be housed within a weather-protecting structure.
4. Blowers shall be equipped with backdraft check dampers to minimize air loss when inoperative.
5. Blower inlets shall be located to provide protection from air contamination. The location of inlets shall be approved.

3102.8.2 Standby Power. Wherever an auxiliary inflation system is required, an approved standby power-generating system shall be provided. The system shall be equipped with a suitable means for automatically starting the generator set upon failure of the normal electrical service and for automatic transfer and operation of all of the required electrical functions at full power within 60 seconds of such service failure. Standby power shall be capable of operating independently for a minimum of four hours.

3102.8.3 Support Provisions. A system capable of supporting the membrane in the event of deflation shall be provided for in air-supported and air-inflated structures having an occupant load of more than 50 or where covering a swimming pool regardless of occupant load. The support system shall be capable of maintaining membrane structures used as a roof for Type I construction not less than 20 feet (6096 mm) above floor or seating areas. The support system shall be capable of maintaining other membranes at least 7 feet (2134 mm) above the floor, seating area or surface of the water.

780 CMR 3103.0 TEMPORARY STRUCTURES

3103.1 General. The provisions of 780 CMR 3103.0 shall apply to structures erected for a period of less than 180 days. Tents and other membrane structures erected for a period of less than 180 days shall comply with the *International Fire Code*. Those erected for a longer period of time shall comply with applicable sections of 780 CMR.

Exception. Provisions of the *International Fire Code* shall apply to tents and membrane structures erected for a period of less than 180 days.

3103.1.1 Permit Required. Temporary structures that cover an area in excess of 120 square feet (11.16 m^2), including connecting areas or spaces with a common means of egress or entrance which are used or intended to be used for the gathering together of ten or more persons, shall not be erected, operated or maintained for any purpose without obtaining a permit from the building official.

3103.2 Construction Documents. A permit application and construction documents shall be submitted for each installation of a temporary structure. The construction documents shall include a site plan indicating the location of the temporary structure and information delineating the means of egress and the occupant load.

3103.3 Location. Temporary structures shall be located in accordance with the requirements of Table 602 based on the fire-resistance rating of the exterior walls for the proposed type of construction.

3103.4 Means of Egress. Temporary structures shall conform to the means of egress requirements of 780 CMR 10.00 and shall have a maximum exit access travel distance of 100 feet (30 480 mm).

780 CMR 3104.0 PEDESTRIAN WALKWAYS AND TUNNELS

3104.1 General. 780 CMR 3104.0 shall apply to connections between buildings such as pedestrian walkways or tunnels, located at, above or below grade level, that are used as a means of travel by persons. The pedestrian walkway shall not contribute to the building area or the number of stories or height of connected buildings.

Note that pedestrian walkways and tunnels shall also conform to applicable requirements of 521 CMR.

3104.2 Separate Structures. Connected buildings shall be considered to be separate structures.

Exceptions:

1. Buildings on the same lot in accordance with 780 CMR 503.1.3.
2. For purposes of calculating the number of Type B units required by Chapter 11, structurally connected buildings and buildings with multiple wings shall be considered one structure.

3104.3 Construction. The pedestrian walkway shall be of noncombustible construction.

Exception. Combustible construction shall be permitted where connected buildings are of combustible construction.

3104.4 Contents. Materials and decorations in the walkway shall conform to the requirements of

780 CMR 8.00 and the requirements of 527 CMR the Massachusetts Fire Code as applicable.

3104.5 Fire Barriers Between Pedestrian Walkways and Buildings. Walkways shall be separated from the interior of the building by fire barrier walls with a fire-resistance rating of not less than two hours. This protection shall extend vertically from a point ten feet (3048 mm) above the walkway roof surface or the connected building roof line, whichever is lower, down to a point ten feet (3048 mm) below the walkway and horizontally ten feet (3048 mm) from each side of the pedestrian walkway. Openings within the ten-foot (3048 mm) horizontal extension of the protected walls beyond the walkway shall be equipped with devices providing a ¾-hour fire protection rating in accordance with 780 CMR 715.0.

Exception. The walls separating the pedestrian walkway from a connected building are not required to have a fire-resistance rating by 780 CMR 3104.5 where any of the following conditions exist:

1. The distance between the connected buildings is more than 10 feet (3048 mm), the pedestrian walkway and connected buildings are equipped throughout with an automatic sprinkler system in accordance with NFPA 13 and the wall is constructed of a tempered, wired or laminated glass wall and doors subject to the following:
    1.1. The glass shall be protected by an automatic sprinkler system in accordance with NFPA 13 and the sprinkler system shall completely wet the entire surface of interior sides of the glass wall when actuated.
    1.2. The glass shall be in a gasketed frame and installed in such a manner that the framing system will deflect without breaking (loading) the glass before the sprinkler operates.
    1.3. Obstructions shall not be installed between the sprinkler heads and the glass.
2. The distance between the connected buildings is more than 10 feet (3048 mm), and both sidewalls of the pedestrian walkway are at least 50 percent open with the open area uniformly distributed to prevent the accumulation of smoke and toxic gases.
3. Buildings are on the same lot, in accordance with Section 503.1.3.
4. Where exterior walls of connected buildings are required by Section 704 to have a fire-resistance rating greater than 2 hours, the walkway shall be equipped throughout with an automatic sprinkler system installed in accordance with NFPA 13.

Exceptions 1. through 4. shall apply to pedestrian walkways having a maximum height above grade of three stories or 40 feet (12 192 mm), or five stories or 55 feet (16 764 mm) where sprinklered.

3104.6 Public Way. Pedestrian walkways over a public way shall also comply with 780 CMR 32.00.

3104.7 Egress. Access shall be provided at all times to a pedestrian walkway that serves as a required exit.

3104.8 Width. The unobstructed width of pedestrian walkways shall not be less than 36 inches (914 mm). The total width shall not exceed 30 feet (9144 mm).

3104.9 Exit Access Travel. The length of exit access travel shall not exceed 200 feet (60 960 mm).

Exceptions:

1. Exit access travel distance on a pedestrian walkway equipped throughout with an automatic sprinkler system in accordance with NFPA 13 shall not exceed 250 feet (76 200 mm).
2. Exit access travel distance on a pedestrian walkway constructed with both sides at least 50 percent open shall not exceed 300 feet (91 440 mm).
3. Exit access travel distance on a pedestrian walkway constructed with both sides at least 50 percent open, and equipped throughout with an automatic sprinkler system in accordance with NFPA 13, shall not exceed 400 feet (122 m).

3104.10 Tunneled Walkway. Separation between the tunneled walkway and the building to which it is connected shall not be less than two-hour fire-resistant construction and openings therein shall be protected in accordance with Table 715.3.

3104.11 Ventilation. Smoke and heat vents shall be provided for enclosed walkways and tunneled walkways as required for Group F-1 occupancies in accordance with 780 CMR 910.0.

780 CMR 3105.0 AWNINGS AND CANOPIES

3105.1 General. Awnings or canopies shall comply with the requirements of 780 CMR 3105.0 and other applicable sections of 780 CMR.

3105.2 Definition. The following term shall, for the purposes of 780 CMR 3105.0 and as used elsewhere in 780 CMR, have the meaning shown in 780 CMR 3105.2.

RETRACTABLE AWNING. A retractable awning is a cover with a frame that retracts against a building or other structure to which it is entirely supported.

3105.3 Design and Construction. Awnings and canopies shall be designed and constructed to withstand wind or other lateral loads and live loads as required by 780 CMR 16.00 with due allowance for shape, open construction and similar features that relieve the pressures or loads. Structural members shall be protected to prevent deterioration. Awnings shall have frames of noncombustible material, fire-retardant-treated wood, wood of Type IV size, or 1-hour construction with combustible or noncombustible covers and shall be either fixed, retractable, folding or collapsible.

3105.4 Canopy Materials. Canopies shall be constructed of a rigid framework with an approved covering, that is flame resistant in accordance with NFPA 701 or has a flame spread index not greater than 25 when tested in accordance with ASTM E 84.

780 CMR 3106.0 MARQUEES

3106.1 General. Marquees shall comply with 780 CMR 3106.0 and other applicable sections of 780 CMR.

3106.2 Thickness. The maximum height or thickness of a marquee measured vertically from its lowest to its highest point shall not exceed three feet (914 mm) where the marquee projects more than two-thirds of the distance from the property line to the curb line, and shall not exceed nine feet (2743 mm) where the marquee is less than ⅔ of the distance from the property line to the curb line.

3106.3 Roof Construction. Where the roof or any part thereof is a skylight, the skylight shall comply with the requirements of 780 CMR 24.00. Every roof and skylight of a marquee shall be sloped to downspouts that shall conduct any drainage from the marquee in such a manner so as not to spill over the sidewalk.

3106.4 Location Prohibited. Every marquee shall be so located as not to interfere with the operation of any exterior standpipe, and such that the marquee does not obstruct the clear passage of stairways or exit discharge from the building or the installation or maintenance of street lighting.

3106.5 Construction. A marquee shall be supported entirely from the building and constructed of noncombustible materials. Marquees shall be designed as required in 7802 CMR 16.00. Structural members shall be protected to prevent deterioration.

780 CMR 3107.0 SIGNS

3107.1 General. Signs shall be designed, constructed and maintained in accordance with 780 CMR.

780 CMR 3108.0 RADIO AND TELEVISION TOWERS

3108.1 General. Subject to the provisions of 780 CMR 16.00 and the requirements of 780 CMR 15.00 governing the fire-resistance ratings of buildings for the support of roof structures, radio and television towers shall be designed and constructed as provided in 780 CMR 3108.0.

3108.2 Location and Access. Towers shall be located and equipped with step bolts and ladders so as to provide ready access for inspection purposes. Guy wires or other accessories shall not cross or encroach upon any street or other public space, or over above-ground electric utility lines, or encroach upon any privately owned property without written consent of the owner of the encroached-upon property, space or above-ground electric utility lines.

3108.3 Construction. Towers shall be constructed of approved corrosion-resistant noncombustible material. The minimum type of construction of isolated radio towers not more than 100 feet (30 480 mm) in height shall be Type IIB.

3108.4 Loads. Towers shall be designed to resist wind loads in accordance with TIA/EIA-222. Consideration shall be given to conditions involving wind load on ice-covered sections in localities subject to sustained freezing temperatures.

3108.4.1 Dead Load. Towers shall be designed for the dead load plus the ice load in regions where ice formation occurs.

3108.4.2 Wind Load. Adequate foundations and anchorage shall be provided to resist two times the calculated wind load.

3108.5 Grounding. Towers shall be permanently and effectively grounded ***per the requirements of 527 CMR 12.00: the Massachusetts Electrical Code.***

780 CMR 3109.0 SWIMMING POOL ENCLOSURES AND SAFETY DEVICES

3109.1 General. Refer to Appendix 780 CMR 120.M.

NON-TEXT PAGE

780 CMR 32.00

ENCROACHMENTS INTO THE PUBLIC RIGHT-OF-WAY

780 CMR 3201.0 GENERAL

3201.1 Scope. The provisions of 780 CMR 32.00 shall govern the encroachment of structures into the public right-of-way.

> *Note: 310 CMR 10.00 Massachusetts Wetlands Regulations, the Massachusetts Stormwater Policy, local sewer use regulations and local bylaws/ordinances regulating stormwater discharges also set requirements, that, when applicable must be satisfied. Likewise drainage requirements of 248 CMR, when applicable must also be satisfied*

3201.2 Measurement. The projection of any structure or appendage shall be the distance measured horizontally from the lot line to the outermost point of the projection.

3201.3 Other Laws. The provisions of 780 CMR 32.00 shall not be construed to permit the violation of other laws or ordinances regulating the use and occupancy of public property.

3201.4 Drainage. Drainage water collected from a roof, awning, canopy or marquee, and condensate from mechanical equipment shall not flow over a public walking surface.

780 CMR 3202.0 ENCROACHMENTS

3202.1 Encroachments below Grade. Encroachments below grade shall comply with 780 CMR 3202.1.1 through 3202.1.3.

3202.1.1 Structural Support. A part of a building erected below grade that is necessary for structural support of the building or structure shall not project beyond the lot lines, except that the footings of street walls or their supports which are located at least eight feet (2438 mm) below grade shall not project more than 12 inches (305 mm) beyond the street lot line.

3202.1.2 Vaults and Other Enclosed Spaces. The construction and utilization of vaults and other enclosed space below grade shall be subject to the terms and conditions of the authority or legislative body having jurisdiction.

3202.1.3 Areaways. Areaways shall be protected by grates, guards or other approved means.

3202.2 Encroachments above Grade and below Eight Feet in Height. Encroachments into the public right-of-way above grade and below eight feet (2438 mm) in height shall be prohibited except as provided for in 780 CMR 3202.2.1 through 3202.2.3. Doors and windows shall not open or project into the public right-of-way.

3202.2.1 Steps. Steps shall not project more than 12 inches (305 mm) and shall be guarded by approved devices not less than three feet (914 mm) high, or shall be located between columns or pilasters.

3202.2.2 Architectural Features. Columns or pilasters, including bases and moldings shall not project more than 12 inches (305 mm). Belt courses, lintels, sills, architraves, pediments and similar architectural features shall not project more than four inches (102 mm).

3202.2.3 Awnings. The vertical clearance from the public right-of-way to the lowest part of any awning, including valances, shall be seven feet (2134 mm) minimum.

3202.3 Encroachments Eight Feet or More above Grade. Encroachments eight feet (2438 mm) or more above grade shall comply with 780 CMR 3202.3.1 through 3202.3.4.

3202.3.1 Awnings, Canopies, Marquees and Signs. Awnings, canopies, marquees and signs shall be constructed so as to support applicable loads as specified in 780 CMR 16.00. Awnings, canopies, marquees and signs with less than 15 feet (4572 mm) clearance above the sidewalk shall not extend into or occupy more than two-thirds the width of the sidewalk measured from the building. Stanchions or columns that support awnings, canopies, marquees and signs shall be located not less than two feet (610 mm) in from the curb line.

3202.3.2 Windows, Balconies, Architectural Features and Mechanical Equipment. Where the vertical clearance above grade to projecting windows, balconies, architectural features or mechanical equipment is more than eight feet (2438 mm), one inch (25 mm) of encroachment is permitted for each additional one inch (25 mm) of clearance above eight feet (2438 mm) but the maximum encroachment shall be four feet (1219 mm).

3202.3.3 Encroachments 15 Feet or More above Grade. Encroachments 15 feet (4572 mm) or more above grade shall not be limited.

3202.3.4 Pedestrian Walkways. The installation of a pedestrian walkway over a public right-of-way shall be subject to the approval of local authority having jurisdiction. The vertical clearance from the public right-of-way to the lowest part of a pedestrian walkway shall be 15 feet (4572 mm) minimum.

3202.4 Temporary Encroachments. Where allowed by the local authority having jurisdiction, vestibules and storm enclosures shall not be erected for a period of time exceeding seven months in any one year and shall not encroach more than three feet (914 mm) nor more than ¼ of the width of the sidewalk beyond the street lot line. Temporary entrance awnings shall be erected with a minimum clearance of seven feet (2134 mm) to the lowest portion of the hood or awning where supported on removable steel or other approved noncombustible support.

780 CMR 33.00

SAFEGUARDS DURING CONSTRUCTION

780 CMR 3301.0 GENERAL

3301.1 Scope. The provisions of 780 CMR 33.00 shall govern safety during construction and the protection of adjacent public and private properties.

> *Note 1: As applicable, Department of Environmental Protection (DEP) Regulations, 310 CMR 7.09: U Dust, Odor, Construction and Demolition, and 310 CMR 15.00: U Asbestos, DEP Regulations addressing asbestos, and the requirements of M.G.L. c. 111, § 150A, addressing disposal of demolition debris, must be satisfied.*
>
> *Note 2: As applicable, 527 CMR, in conjunction with M.G.L. c. 148, § 27A must be satisfied relative to fire protection systems proposed dismantled, shut off or modified; likewise 527 CMR addresses certain fire extinguisher requirements associated with demolition activities.*
>
> *Note 3: As applicable, 521 CMR sets forth pedestrian walkway requirements for the disabled and such requirements must be satisfied.*

3301.2 Storage and Placement. Construction equipment and materials shall be stored and placed so as not to endanger the public, the workers or adjoining property for the duration of the construction project.

780 CMR 3302.0 CONSTRUCTION SAFEGUARDS

3302.1 Remodeling and Additions. Required exits, existing structural elements, fire protection devices and sanitary safeguards shall be maintained at all times during remodeling, alterations, repairs or additions to any building or structure.

Exceptions:
1. When such required elements or devices are being remodeled, altered or repaired, adequate substitute provisions shall be made.
2. When the existing building is not occupied.

3302.2 Manner of Removal. Waste materials shall be removed in a manner which prevents injury or damage to persons, adjoining properties and public rights-of-way.

780 CMR 3303.0 DEMOLITION

3303.1 Construction Documents. Construction documents and a schedule for demolition must be submitted when required by the building official. Where such information is required, no work shall be done until such construction documents or schedule, or both, are approved.

3303.2 Pedestrian Protection. The work of demolishing any building shall not be commenced until pedestrian protection is in place as required by 780 CMR 33.00.

3303.3 Means of Egress. A party wall balcony or horizontal exit shall not be destroyed unless and until a substitute means of egress has been provided and approved.

3303.4 Vacant Lot. Where a structure has been demolished or removed, the vacant lot shall be filled and maintained to the existing grade or in accordance with the ordinances of the jurisdiction having authority.

3303.5 Water Accumulation. Provision shall be made to prevent the accumulation of water or damage to any foundations on the premises or the adjoining property.

3303.6 Utility Connections. Service utility connections shall be discontinued and capped in accordance with the approved rules and the requirements of the authority having jurisdiction.

780 CMR 3304.0 SITE WORK

3304.1 Excavation and Fill. Excavation and fill for buildings and structures shall be constructed or protected so as not to endanger life or property. Stumps and roots shall be removed from the soil to a depth of at least 12 inches (305 mm) below the surface of the ground in the area to be occupied by the building. Wood forms which have been used in placing concrete, if within the ground or between foundation sills and the ground, shall be removed before a building is occupied or used for any purpose. Before completion, loose or casual wood shall be removed from direct contact with the ground under the building.

3304.1.1 Slope Limits. Slopes for permanent fill shall not be steeper than one unit vertical in two units horizontal (50% slope). Cut slopes for permanent excavations shall not be steeper than one unit vertical in two units horizontal (50% slope). Deviation from the foregoing limitations for cut slopes shall be permitted only upon the presentation of a soil investigation report acceptable to the building official.

3304.1.2 Surcharge. No fill or other surcharge loads shall be placed adjacent to any building or structure unless such building or structure is capable of withstanding the additional loads caused by the fill or surcharge. Existing footings or foundations which can be affected by any excavation shall be underpinned adequately or otherwise protected against settlement and shall be protected against later movement.

3304.1.3 Footings on Adjacent Slopes. For footings on adjacent slopes, see 780 CMR 18.00.

3304.1.4 Fill Supporting Foundations. Fill to be used to support the foundations of any building or structure shall comply with 780 CMR 18.00. Special inspections of compacted fill shall be in accordance with 780 CMR 17.00.

780 CMR 3305.0 SANITARY

*3305.1 Facilities Required. Sanitary facilities shall be provided during construction, remodeling or demolition activities in accordance with 105 CMR, the State Sanitary Code and 248 CMR, the **Massachusetts Fuel Gas and Plumbing Code**.*

780 CMR 3306.0 PROTECTION OF PEDESTRIANS

3306.1 Protection Required. Pedestrians shall be protected during construction, remodeling and demolition activities as required by 780 CMR 33.00 and Table 3306.1. Signs shall be provided to direct pedestrian traffic.

3306.2 Walkways. A walkway shall be provided for pedestrian travel in front of every construction and demolition site unless the authority having jurisdiction authorizes the sidewalk to be fenced or closed. Walkways shall be of sufficient width to accommodate the pedestrian traffic, but in no case shall they be less than four feet (1219 mm) in width. Walkways shall be provided with a durable walking surface. Walkways shall be accessible in accordance with 780 CMR 11.00 and shall be designed to support all imposed loads and in no case shall the design live load be less than 150 pounds per square foot (psf) (7.2 kN/m^2).

3306.3 Directional Barricades. Pedestrian traffic shall be protected by a directional barricade where the walkway extends into the street. The directional barricade shall be of sufficient size and construction to direct vehicular traffic away from the pedestrian path.

3306.4 Construction Railings. Construction railings shall be at least 42 inches (1067 mm) in height and shall be sufficient to direct pedestrians around construction areas.

3306.5 Barriers. Barriers shall be a minimum of eight feet (2438 mm) in height and shall be placed on the side of the walkway nearest the construction. Barriers shall extend the entire length of the construction site. Openings in such barriers shall be protected by doors which are normally kept closed.

3306.6 Barrier Design. Barriers shall be designed to resist loads required in 780 CMR 16.00 unless constructed as follows:

1. Barriers shall be provided with two-inch by four-inch (51 mm by 102 mm) top and bottom plates.
2. The barrier material shall be a minimum of ¾-inch (19.1 mm) boards or ¼-inch (6.4 mm) wood structural use panels.
3. Wood structural use panels shall be bonded with an adhesive identical to that for exterior wood structural use panels.
4. Wood structural use panels ¼ inch (6.4 mm) or $^{5}/_{16}$ inch (23.8 mm) in thickness shall have studs spaced not more than two feet (610 mm) on center (o.c.).
5. Wood structural use panels ⅜ inch (9.5 mm) or ½ inch (12.7 mm) in thickness shall have studs spaced not more than four feet (1219 mm) o.c., provided a two-inch by four-inch (51 mm by 102 mm) stiffener is placed horizontally at midheight where the stud spacing exceeds two feet (610 mm) o.c.
6. Wood structural use panels ⅝ inch (15.9 mm) or thicker shall not span over eight feet (2438 mm).

TABLE 3306.1 PROTECTION OF PEDESTRIANS

HEIGHT OF CONSTRUCTION	DISTANCE FROM CONSTRUCTION TO LOT LINE	TYPE OF PROTECTION REQUIRED
eight feet or less	Less than five feet	Construction railings
	five feet or more	None
More than eight feet	Less than five feet	Barrier and covered walkway
	five feet or more, but not more than ¼ the height of construction	Barrier and covered walkway
	five feet or more, but between ¼ and ½ the height of construction	Barrier
	five feet or more, but exceeding ½ the height of construction	None

For SI: 1 foot = 304.8 mm.

3306.7 Covered walkways. Covered walkways shall have a minimum clear height of eight feet (2438 mm) as measured from the floor surface to the canopy overhead. Adequate lighting shall be provided at all times. Covered walkways shall be designed to support all imposed loads. In no case shall the design live load be less than 150 psf (7.2 kN/m^2) for the entire structure.

Exception. Roofs and supporting structures of covered walkways for new, light-frame construction not exceeding two stories in height are permitted to be designed for a live load of 75 psf (3.6kN/m^2) or the loads imposed on them, whichever is greater. In lieu of such designs, the roof and supporting structure of a covered walkway are permitted to be constructed as follows:

1. Footings shall be continuous two-inch by six-inch (51 mm by 152 mm) members.
2. Posts not less than four inches by six inches (102 mm by 152 mm) shall be provided on both sides of the roof and spaced not more than 12 feet (3658 mm) o.c.
3. Stringers not less than four inches by 12 inches (102 mm by 305 mm) shall be placed on edge upon the posts.
4. Joists resting on the stringers shall be at least two inches by eight inches (51 mm by 203 mm) and shall be spaced not more than two feet (610 mm) o.c.
5. The deck shall be planks at least two inches (51 mm) thick or wood structural panels with an exterior exposure durability classification at least $^{23}/_{32}$ inch (18.3 mm) thick nailed to the joists.
6. Each post shall be knee braced to joists and stringers by two-inch by four-inch (51 mm by 102 mm) minimum members four feet (1219 mm) long.
7. A two-inch by four-inch (51 mm by 102 mm) minimum curb shall be set on edge along the outside edge of the deck.

3306.8 Repair, Maintenance and Removal. Pedestrian protection required by 780 CMR 33.00 shall be maintained in place and kept in good order for the entire length of time pedestrians may be endangered. The owner or the owner's agent, upon the completion of the construction activity, shall immediately remove walkways, debris and other obstructions and leave such public property in as good a condition as it was before such work was commenced.

3306.9 Adjacent to Excavations. Every excavation on a site located five feet (1524 mm) or less from the street lot line shall be enclosed with a barrier not less than six feet (1829 mm) high. Where located more than five feet (1524 mm) from the street lot line, a barrier shall be erected when required by the building official. Barriers shall be of adequate strength to resist wind pressure as specified in 780 CMR 16.00.

780 CMR 3307.0 PROTECTION OF ADJOINING PROPERTY

3307.1 Protection Required. Adjoining public and private property shall be protected from damage during construction, remodeling and demolition work. Protection must be provided for footings, foundations, party walls, chimneys, skylights and roofs. Provisions shall be made to control water runoff and erosion during construction or demolition activities. The person making or causing an excavation to be made shall provide written notice to the owners of adjoining buildings advising them that the excavation is to be made and that the adjoining buildings should be protected. Said notification shall be delivered not less than ten days prior to the scheduled starting date of the excavation.

780 CMR 3308.0 TEMPORARY USE OF STREETS, ALLEYS AND PUBLIC PROPERTY

3308.1 Storage and Handling of Materials. The temporary use of streets or public property for the storage or handling of materials or of equipment required for construction or demolition, and the protection provided to the public shall comply with the provisions of the authority having jurisdiction and 780 CMR 33.00.

3308.1.1 Obstructions. Construction materials and equipment shall not be placed or stored so as to obstruct access to fire hydrants, standpipes, fire or police alarm boxes, catch basins or manholes, nor shall such material or equipment be located within 20 feet (6096 mm) of a street intersection, or placed so as to obstruct normal observations of traffic signals or to hinder the use of public transit loading platforms.

3308.2 Utility Fixtures. Building materials, fences, sheds or any obstruction of any kind shall not be placed so as to obstruct free approach to any fire hydrant, fire department connection, utility pole, manhole, fire alarm box or catch basin, or so as to interfere with the passage of water in the gutter. Protection against damage shall be provided to such utility fixtures during the progress of the work, but sight of them shall not be obstructed.

780 CMR 3309.0 FIRE EXTINGUISHERS

[F] 3309.1 Where Required. All structures under construction, alteration or demolition shall be provided with not less than one approved portable fire extinguisher in accordance with 780 CMR 906.0 and sized for not less than ordinary hazard as follows:

1. At each stairway on all floor levels where combustible materials have accumulated.

2. In every storage and construction shed.
3. Additional portable fire extinguishers shall be provided where special hazards exist, such as the storage and use of flammable and combustible liquids.
4. *Fire extinguisher requirements of 527 CMR shall also be satisfied.*

3309.2 Fire Hazards. The provisions of 780 CMR and 527 CMR, the Massachusetts State Fire Code shall be strictly observed to safeguard against all fire hazards attendant upon construction operations.

780 CMR 3310.0 EXITS

3310.1 Stairways required. Where a building has been constructed to a height greater than 50 feet (15 240 mm) or four stories, or where an existing building exceeding 50 feet (15 240 mm) in height is altered, at least one temporary lighted stairway shall be provided unless one or more of the permanent stairways are erected as the construction progresses.

3310.2 Maintenance of Exits. Required means of egress shall be maintained at all times during construction, demolition, remodeling or alterations and additions to any building.

Exception. Approved temporary means of egress systems and facilities.

[F] 780 CMR 3311.0 STANDPIPES

3311.1 Where Required. Buildings four stories or more in height shall be provided with not less than one standpipe for use during construction. Such standpipes shall be installed where the progress of construction is not more than 40 feet (12 192 mm) in height above the lowest level of fire department access. Such standpipe shall be provided with fire department hose connections at accessible locations adjacent to usable stairs. Such standpipes shall be extended as construction progresses to within one floor of the highest point of construction having secured decking or flooring.

3311.2 Buildings Being Demolished. Where a building is being demolished and a standpipe exists within such a building, such standpipe shall be maintained in an operable condition so as to be available for use by the fire department. Such standpipe shall be demolished with the building but shall not be demolished more than one floor below the floor being demolished.

3311.3 Detailed Requirements. Standpipes shall be installed in accordance with the provisions of 780 CMR 9.00.

Exception. Standpipes shall be either temporary or permanent in nature, and with or without a water supply, provided that such standpipes conform to the requirements of 780 CMR 905.0 as to capacity, outlets and materials.

3311.4 Water Supply. Water supply for fire protection, either temporary or permanent, shall be made available as soon as combustible material accumulates.

[F] 780 CMR 3312.0 AUTOMATIC SPRINKLER SYSTEM

3312.1 Completion Before Occupancy. In buildings where an automatic sprinkler system is required by 780 CMR, it shall be unlawful to occupy any portion of a building or structure until the automatic sprinkler system installation has been tested and approved, except as provided in 780 CMR 120.3: *Temporary Occupancy.*

3312.2 Operation of Valves. Operation of sprinkler control valves shall be permitted only by properly authorized personnel and shall be accompanied by notification of duly designated parties. When the sprinkler protection is being regularly turned off and on to facilitate connection of newly completed segments, the sprinkler control valves shall be checked at the end of each work period to ascertain that protection is in service.

780 CMR 3313.0 DESIGN LOADS ON STRUCTURES DURING CONSTRUCTION

3313.1 Design Loads. The design loads on partially completed structures and temporary structures, including scaffolding, bracing and shoring, shall be in accordance with ASCE 37.

3313.2 Structural Integrity During Construction. The structural integrity of partially completed and temporary structures shall comply with ASCE 37, Section 1.3.2.

780 CMR 34.00

EXISTING STRUCTURES

780 CMR 34.00 is entirely unique to Massachusetts

780 CMR 3400.0 SCOPE

3400.1 General. The provisions of 780 CMR 34.00 are intended to maintain or increase public safety, health, and general welfare in existing buildings by permitting repair, alteration, addition, and/or change of use without requiring full compliance with the code for new construction except where otherwise specified in 780 CMR 34.00.

3400.2 Compliance. Repairs, alterations, additions, and changes of use shall conform to the requirements of 780 CMR 34.00. Where compliance with the provisions of this code for new construction is required by 780 CMR 34.00, and where such compliance is impractical because of construction difficulties or regulatory conflicts, *compliance alternatives* as described in 780 CMR 3406.0 may be accepted by the *building official*.

> **Note**. Specialized codes, rules, regulations, and laws pertaining to repair, alteration, addition, or change of use of existing buildings promulgated by various authorized agencies may impact upon the provisions of 780 CMR 34.00. Specialized state codes, rules, regulations, and laws include, but are not limited to those listed in 780 CMR 35.00.

3400.3 Applicability. The provisions of 780 CMR 34 apply to repair, alteration addition or change in use to existing buildings which qualify to use 780 CMR 34.00 (see 780 CMR 3400.3.1), based on the proposed continuation of, or change in use group, as follows:

1. Continuation of the same *use group*, or a change in *use group* which results in a change in *hazard index* of one or less as determined by 780 CMR 3403.0 shall comply with 780 CMR 3404.0.
2. Change in use group to a use group with *hazard index* of two or more greater than the *hazard index* of the existing use shall comply with the requirements of 780 CMR 3405.0 and the code for new construction.
3. Portions of the building is changed to a new *use group*, shall be separated from the remainder of the building with *fire separation assemblies* complying with 780 CMR 302.3, or with approved *compliance alternatives*. The portion of the building changed shall be made to conform with the applicable provisions of 780 CMR 34.00.
4. Additions to *existing buildings* shall comply with all code requirements for new construction, except as otherwise provided in 780 CMR 34.00. The combined height and area of the *existing building* and the addition shall not exceed that allowed by 780 CMR 503.0 and Table 503 as modified by 780 CMR 504.0 and 506.0. Where a *fire wall* complying with 780 CMR 705.0 is provided, the addition shall be considered as a separate building.
5. *Ordinary repairs* conforming to 780 CMR 110.3 item 4. and 780 CMR 2.00 may be performed without a building permit.
6. A change from any other use group to an assembly use group (A) shall comply with the requirements of the code for new construction, except that structural requirements need only conform to 780 CMR 3408.0 and energy conservation requirements need only comply with 780 CMR 3407.0.

   6.1. **Existing A-2nc Use Means of Egress**. For existing buildings or portions thereof that are classified as A-2nc use and which have an occupant load of 50 or greater; which have a single main exit door, such egress system shall conform to the requirements of 780 CMR 10.0. Non-compliance with these requirements shall be cause for the issuance of an Exit Order in accordance with 780 CMR 3400.5.1.

   As an alternative, or where construction, regulations or other conditions exist which would preclude the installation of said main entrance/exit door and associated exit access, the owner shall cause the existing means of egress system to be evaluated by a Massachusetts registered architect or Massachusetts registered professional engineer. Such evaluation shall determine whether the existing means of egress is sufficient to accommodate the occupant load or whether the existing means of egress requires improvement to accommodate safely the occupant load. If the existing means of egress is insufficient to accommodate the occupant load, such inadequate means of egress will, as a minimum, be deemed in violation of 780 CMR 3400.4.1. Calculation methodologies based on alternative approaches to life safety may be utilized in order to effect said egress evaluation.
7. **Institutional Use Groups**. A change from any other use group to an institutional use group (I) shall comply with the requirements of the code for new construction, except that structural requirements need only conform to 780 CMR 3408.0 and energy conservation requirements need only comply with 780 CMR 3407.0.

8. **Residential Use Groups**. A change from any other use group to a residential use group (R) shall comply with the requirements of the code for new construction, except that structural requirements need only conform to 780 CMR 3408.0 and energy conservation requirements need only comply with 780 CMR 3407.0.

9. ***Historic Buildings***. Buildings which qualify as *totally or partially preserved historic buildings* in accordance with 780 CMR 3409.0 shall meet the provisions of 780 CMR 3409.0.

10. **Structural Requirements**. Structural requirements for additions, and for *existing buildings* subject to repair, alteration, and/or change of use, shall be in accordance with 780 CMR 3408.0.

11. **Energy Conservation Requirements**. Energy conservation requirements for additions, and for *existing buildings* subject to repair, alteration, and/or change of use, shall be in accordance with 780 CMR 3407.0.

Exceptions. *House Museums and Preserved Historic Buildings*.

12. **Flood Resistant Construction**. Renovations/Additions to existing buildings in areas prone to flooding are subject to the requirements of 780 CMR 120.G

3400.3.1 Buildings Which Qualify. The provisions of 780 CMR 34.00 shall apply to *existing buildings* which have been legally occupied and/or used for a period of at least five years. Any building for which there exists an outstanding notice of violation or other order of the building official shall not qualify to use 780 CMR 34.00 unless such proposed work includes the abatement of all outstanding violations and compliance with all outstanding orders of the building official. Buildings which do not qualify as *existing buildings* for the purposes of 780 CMR 34.00 shall comply fully with the applicable provisions of 780 CMR for new construction.

Exceptions:

1. For other than structural work, *existing buildings* or portions thereof which are changed in use from any other use group to day care centers (I-2 or E) shall not qualify as *existing buildings* for the purposes of 780 CMR 34.00, but shall comply with the requirements of 780 CMR 4.00, as applicable.
2. For other than structural work, *existing buildings* or portions thereof, which are changed in use from any use to a Group Residence, Limited Group Residence or Group Dwelling Unit shall not qualify as *existing buildings* for the purposes of 780 CMR 34.00, but shall comply with the provisions of 780 CMR 4.00, as applicable.

3400.4 Special Provisions for Means of Egress.

3400.4.1 Existing Non Conforming Means of Egress. The following conditions, when observed by the *building official*, shall be cited, in writing as a violation. Said citation shall order the abatement of the non conformance and shall include such a time element as the building official deems necessary for the protection of the occupants thereof, or as otherwise provided for by statute.

1. Less than the number of *means of egress* serving every space and/or story, required by 780 CMR 10.00 or 780 CMR 5311.0 for one and two family dwellings.
2. Any required *means of egress* component which is not of sufficient width to comply with 780 CMR 10.00, or is not so arranged as to provide safe and adequate *means of egress*, including exit signage and emergency lighting.

3400.4.1.1 Assembly Nightclubs (A-2nc) Main Entrance/Exit Door Size. Where the occupant load of an existing A-2nc use is 50 or greater, the main entrance/exit door shall be a minimum 72 inches (nominal) width. This main entrance/exit door shall consist of a pair of side-hinged swinging type doors without a center mullion and shall be equipped with panic hardware – also see 780 CMR 1011.3.

3400.4.2 Fire Escapes. Fire escapes shall be permitted only as provided for in 780 CMR 3400.4.2

3400.4.2.1 New Buildings. Fire escapes shall not constitute any part of the required means of egress in new buildings.

3400.4.2.2 Existing Fire Escapes. Existing fire escapes shall be continued to be accepted as a component in the means of egress in existing buildings only.

3400.4.2.3 New Fire Escapes. New fire escapes for existing buildings shall be permitted only where exterior stairs cannot be utilized due to lot lines limiting stair size or due to the sidewalks, alleys or roads at grade level. New fire escapes shall not incorporate ladders or access by windows.

3400.4.2.4 Limitations. Fire escapes shall comply with this section and shall not constitute more than 50% of the required number of exits nor more than 50% of the required exit capacity.

3400.4.2.5 Location. Where located on the front of the building and where projecting beyond the building line, the lowest landing shall not be less than seven feet (2134 mm) or more than 12 feet (3658 mm) above grade, and shall be equipped with a counterbalanced stairway to the street. In alleyways and thoroughfares less than 30 feet (9144 mm) wide, the clearance under the lowest landing shall not be less than 12 feet (3658 mm).

3400.4.2.6 Construction. The fire escape shall be designed to support a live load of 100 pounds per square foot (4788 Pa) and shall be constructed of steel or other approved noncombustible materials. Fire escapes constructed of wood not less than nominal two inches (51 mm) thick are permitted on buildings of Type 5 construction. Walkways and railings located over or supported by combustible roofs in buildings of Type 3 and 4 construction are permitted to be of wood not less than nominal two inches (51 mm) thick.

3400.4.2.7 Dimensions. Stairs shall be at least 22 inches (559 mm) wide with risers not more than, and treads not less than, eight inches (203 mm) and landings at the foot of stairs not less than 40 inches (1016 mm) wide by 36 inches (914 mm) long, located not more than eight inches (203 mm) below the door.

3400.4.2.8 Opening Protectives. Doors and windows along the fire escape shall be protected with ¾-hour opening protectives.

3400.4.2.9 Testing and Certification. All exterior bridges, steel or wooden stairways, fire escapes and egress balconies and their structural anchorage shall be examined and/or tested, and certified for structural adequacy and safety every five years, by a Massachusetts registered professional engineer, or others qualified and acceptable to the building official; said engineer or others shall then submit an affidavit to the building official.

3400.5 *Hazardous Means of Egress*.

3400.5.1 Exit Order/Hazardous *Means of Egress*. In any *existing building* or structure not provided with exit facilities as herein prescribed for new buildings and in which the exits are deemed hazardous or dangerous to life and limb, the *building official* shall declare such building dangerous and unsafe in accordance with the provisions of 780 CMR 121.0.

3400.5.2 Appeal from Exit Order. Any person served with any order pursuant to 780 CMR 3400.5 shall have the remedy prescribed in 780 CMR 121.0.

3400.6 Unsafe Lighting and/or Unsafe Ventilation. In any *existing building* , or portion thereof, in which (a) the light or ventilation do not meet the applicable provisions of 780 CMR 12.00 and (b) which, in the opinion of the *building official*, are dangerous, or hazardous, to the health and safety of the occupants, the *building official* shall order the abatement of such conditions to render the building or structure occupiable or habitable as applicable for the posted use and occupant load.

In enforcing the provisions of 780 CMR 3400.6 the *building official* may require or accept engineering or other evaluations of the lighting and/or ventilation systems in order to evaluate possible dangerous or hazardous conditions and acceptable solutions.

Where full compliance with 780 CMR for new construction is not practical for structural and/or other technical reasons, the *building official* may accept compliance alternatives, or engineering or other evaluations which adequately address the building or structure livability for the posted use and occupant load.

3400.7 Change in Commodity or Storage Arrangement. *Existing buildings*, or portions thereof, in which there is a change in occupancy classification, commodity classification, or storage arrangement, as defined by NFPA 13, requires an evaluation of the existing sprinkler system for compliance with NFPA 13 and NFPA 25.

In enforcing the provisions of 780 CMR 3400.7 the *building official* may require or accept engineering or other evaluations of the fire protection systems in order to identify possible non-compliant conditions and acceptable solutions. If the evaluation determines that alterations are necessary, the *building official* shall order the abatement of such conditions.

780 CMR 3401.0 DEFINITIONS

3401.1 General. Definitions shall, for the purposes of 780 CMR 3401.0, have the meaning shown in 780 CMR 3401.1.

Building System. Any mechanical, structural, egress, electrical, plumbing, building enclosure and/or fire protection system, or fire resistive construction system, or portion thereof.

Building System Component. A part or portion of a *building system*.

Compliance Alternative. An alternative life-safety construction feature which meets or exceeds the requirements or intent of a specific provision of 780 CMR. The *Building Official* is authorized to approve or disapprove *compliance alternatives*. *Compliance alternatives* are only permitted for *existing buildings*.

Existing Building or Structure. Any building or structure qualifying under 780 CMR 3400.3.1.

Hazard Index. A numerical value, between 1 and 8, which is assigned to a specific *Use Group* in order to determine which of the provisions of 780 CMR 34.00 apply to the proposed work on the *existing building*. The *Hazard Index* is a relative scale used only to determine applicable provisions of 780 CMR 34.00. *Hazard indices* are listed in Table 3403 and 780 CMR 120.S.

Historic Buildings. (a) Any building or structure individually listed on the National Register of Historic Places or (b) any building or structure evaluated by MHC to be a contributing building within a National Register or State Register District. (c) any building or structure which has been certified by the Massachusetts Historical Commission to meet eligibility requirements for individual listing on the National Register of Historic Places. Historic building shall be further defined as totally or partially preserved buildings. All entries into the house museum list shall be certified by the Massachusetts Historical Commission. The Board of Building Regulations and Standards shall ratify all buildings or structures certified by the Massachusetts Historical Commission to qualify for *house museum* listing (*see* 780 CMR 120.Y).

Partially Preserved Buildings. (a) Any building or structure individually listed on the National Register of Historic Places or (b) any building or structure certified as a historic building by the Massachusetts Historical (Commission/t and not designated a *house museum* in 780 CMR 120.Y.

Restoration. *Restoration* is the process of accurately reconstructing or repairing the forms and details of a building or structure or portion thereof as it appeared at a particular period or periods of time by means of removal of later work/or the replacement of missing original work

House Museums. A *house museum* is an *historic building* or structure. The principal use of such a building or structure must be as an exhibit of the building or the structure itself which is open to the public not less than 12 days per year, although additional uses, original and/ or ancillary to the principal use shall be permitted within the same building up to maximum of 40% of the gross floor area. *House museums* shall be those listed in 780 CMR 120.Y. All entries into the *house museum* list shall be certified by the Massachusetts Historical Commission. The Board of Building Regulations and Standards shall ratify all buildings or structures certified by the Massachusetts Historical Commission to qualify for *totally preserved* listing (See *Appendix 120.Y*).

Substantial Renovation, or Substantial Alteration. The terms *substantial renovation* and *substantial alteration* are defined herein for the specific purpose of determining whether fire protective systems are required in existing buildings, when such buildings undergo renovations or alterations, change in use or occupancy or additions. As used in 780 CMR 34.00, *substantial renovation* or *substantial alteration* shall have the following meanings; *Substantial renovation* and *substantial alteration* is work which is major in scope *and* expenditure when compared to the work and expenditure required for the installation of a fire protection system, when such system is required by 780 CMR 9.00 for a particular *use group*. Work shall not be considered a substantial alteration if the cost of installing the fire protection system exceeds 15% of the total renovation cost. The *building official* shall make such determination and may request the owner or applicant to provide such supporting information as is necessary to make such determination

780 CMR 3402.0 IMPLEMENTATION

3402.1 Building Permit Application Requirements for *Existing Buildings*. A building permit shall be required for any work regulated by 780 CMR 34.00.

Exception. *Ordinary repairs* may be performed without a building permit.

3402.1.1 Investigation and Evaluation. For any proposed work regulated by 780 CMR 34.00, which is subject to 780 CMR 116.0, as a condition of the issuance of a building permit the building owner shall cause the *existing building* (or portion thereof) to be investigated and evaluated in accordance with the provisions of 780 CMR 34.00 (*see* 780 CMR 120.S).

The investigation and evaluation shall be in sufficient detail to ascertain the effects of the proposed work (if any) on the structural, egress, fire protection, energy conservation systems and light and ventilation systems of the space under consideration and, where necessary, the entire building or structure.

3402.1.2 Submittal. The results of the investigation and evaluation, along with any proposed *compliance alternatives*, shall be submitted to the *building official* in written report form.

3402.1.3 Non Conformities and *Compliance Alternatives*. The application for a building permit shall identify all items of non or partial compliance with the requirements of 780 CMR 34.00, and *compliance alternatives*, if any are proposed, for approval by the building official. The *building official* shall respond to the acceptability of any proposed *compliance alternatives* within 30 days of the filing of the building permit application. Where proposed *compliance alternatives* are, in the opinion of the *building official*, unacceptable, or where issues of non-compliance remain, the permit applicant shall have the remedies prescribed by 780 CMR 122.0.

3402.1.4 Documentation of *Compliance Alternatives*. Whenever action is taken on any building permit application to repair, make alterations or additions, or change the use or occupancy of an existing building, and when said application proposes the use of *compliance alternatives*, the building official shall ensure that one copy of the proposed *compliance alternatives*, including applicable plans, test data, or other data for evaluation, be submitted to the BBRS, together with a copy of the building permit application and the *building official's* decision regarding the proposed *compliance alternatives*.

780 CMR 3403.0 *HAZARD INDEX*

3403.1 ***Hazard Index***. In the implementation of the provisions of 780 CMR 34, the *hazard index* associated with a particular use group shall be as identified in table 3403 and 780 CMR 120.S. In order to determine the applicable provisions of 780 CMR 34.00 the *hazard index* of the existing *use group* shall be subtracted from the *hazard index* of the proposed use. The algebraic difference shall be used to determine the applicable provisions of 780 CMR 34.00.

TABLE 3403 HAZARD INDEX

USE GROUP(1)	DESCRIPTION	HAZARD INDEX NO.(2)
A-1	Theater with stage	6
A-2nc	Night Club	7
A-3	Theater without stage	5
A-2r	Restaurant	5
A-3	Lecture halls, recreations centers, museums, libraries, churches, similar assembly buildings	4
A-4	Indoor arenas, skating rinks, swimming pools, tennis courts	4
A-5	Bleachers, amusement park structures, grandstands, stadiums	4
B	Business	2
E	Educational (K through 12)	4
F	Factory and industrial	3
H	High hazard	8
I-1	Residential Board & Care; Social rehabilitation facilities; alcohol and drug centers; convalescent homes	4
I-2	Institutional incapacitated	4
I-3	Institutional restrained	5
I-4	Day care Centers for two years nine months or younger	4
M	Mercantile	3
R-1	Hotels, motels	4
R-2	Multi-family (4 or more dwellings)	4
R-2	Multi-family (3 dwellings)	2
R-3	Multiple single-family, One and two family	2
R-4	Residential care/Assisted Living facilities of 6-16 occupants excluding staff	2
S-1	Storage, moderate hazard	3
S-2	Storage, low hazard	1

Notes to Table 3403.

(1) See 780 CMR 3.00 and 4.00 and 780 CMR 120.S.

(2) Hazard Index Modifier for selected construction types as follows.

(a) When a building is classified in construction Type IA, IB, or IIA, subtract one from the *Hazard index* shown in Table 3403 for the applicable proposed new use group only.

(b) When a building is classified in construction VB, add one to the *Hazard index* shown in Table 3403 for the applicable proposed new use group only. Exception. *Partially Preserved Historic Buildings* (780 CMR 3409.0).

780 CMR 3404.0 REQUIREMENTS FOR CONTINUATION OF THE SAME *USE GROUP* OR CHANGE TO A *USE GROUP* RESULTING IN A CHANGE IN *HAZARD INDEX* OF ONE OR LESS

3404.1 General. The requirements of 780 CMR 3404.0 and applicable provisions of 780 CMR 3408.0 shall apply to all repairs and alterations to *existing buildings* having a continuation of the same use group or to *existing buildings* changed in use group of one or less *hazard index* (Table 3403).

3404.2 Requirements Exceeding Those Required for New Construction. *Existing buildings* which, in part or as a whole, exceed the requirements of 780 CMR may be altered, in the course of compliance with 780 CMR 34.00, so as to reduce or remove, in part or completely, features not required by 780 CMR for new construction.

> **Exception**. Pursuant to M.G.L. c. 148, § 27A, fire protection devices, shall not be disconnected (temporarily or permanently), obstructed, removed or shut off or destroyed without first procuring a written permit from the head of the local fire department.

3404.3 New ***Building Systems***. Any new *building system* or portion thereof shall conform to 780 CMR for new construction to the fullest extent practical. However, individual *components* of an existing *building system* may be repaired or replaced without requiring that system to comply fully with the code for new construction unless specifically required by 780 CMR 3408.0.

3404.4 Alterations and Repairs. Alterations or repairs to *existing buildings* which maintain or improve the performance of the building may be made with the same or like materials, unless required otherwise by 780 CMR 3408.0. Alterations or repairs which have the effect of replacing a *building system* as a whole shall comply with 780 CMR 3404.3

3404.5 Number of ***Means of Egress***. Every floor or story of any existing building shall provide at least the number of *means of egress* as required by 780 CMR 3400.4 and which are acceptable to the *building official*.

3404.6 Capacity of Exits. All required *means of egress* shall comply with 780 CMR 10.00. Existing *means of egress* may be used to contribute to the total egress capacity requirement based on the unit egress widths of 780 CMR 10.00.

3404.7 Exit Signs and Lights. Exit signs and lighting shall be provided in accordance with 780 CMR 10.00.

3404.8 Means of Egress Lighting. *Means of egress* lighting shall be provided in accordance with 780 CMR 10.00.

3404.9 Height and Area Limitations. The height and area requirements of 780 CMR 5.00 shall apply to *existing buildings* when such *existing buildings* are modified by addition and/or change in use. Modifications to the height and area requirements as provided in 780 CMR 504.0 and 506.0 are permitted.

3404.10 Existing Fire Walls/Partitions. No further compliance is required with 780 CMR 7.00. The height above the roof of existing fire, partitions and exterior walls need not comply with 780 CMR 3404.0

3404.11 Fire Protection Systems. Fire Protection Systems. Design, installation and maintenance of fire protection systems shall be provided in accordance with 780 CMR 3404.3 and 780 CMR 3404.12 as applicable.

3404.12 Fire Protection Systems Are Required for the Following Cases.

1. Additions where required by 780 CMR 9.00 for the specific *use group.*
2. For *existing buildings modified by* addition and/or change in use where required by 780 CMR 504.0 or 506.0 to satisfy height and area requirements.
3. *Existing buildings*, or portions thereof which are *substantially altered* or *substantially renovated*, and where otherwise required by 780 CMR 9.00 for the specific use group.
4. Existing buildings or portions thereof when changed in use to an A-2nc occupancy shall be protected with an automatic fire suppression system. Where the A-2nc occupancy is created in a mixed use building, the A-2nc occupancy, including all ingress and egress portions shall require automatic fire suppression when the A-2nc occupant load is 50 or greater; additionally in such mixed use, the A-2nc occupancy shall be separated from adjacent uses by one hour horizontal and vertical fire separation assemblies in accordance with the applicable provisions of 780 CMR 7.00.

> **Note.** Notwithstanding the provisions of 780 CMR 3404.12, automatic Fire Suppression systems are required in municipalities which have adopted the provisions of M.G.L. c. 148, § 26G, H or I; also see M.G.L. c. 143, § 97A, and M.G.L. c. 148, § 26G½ relative to statutory prospective and retroactive sprinkler requirements for nightclubs and similar Uses.

3404.13 Enclosure of Stairways. Open stairways are prohibited except in one- and two-family dwellings or unless otherwise permitted by 780 CMR 10.00. There shall be no minimum fireresistance rating required for an existing enclosure of a stairway. Partitions or other new construction which is added in order to fully and solidly enclose a stairway shall provide a minimum fireresistance rating of one hour. All doors in the enclosure shall be self-closing and tight-fitting with approved hardware. All doors in those portions of the stairway which are fireresistance rated shall comply to the applicable provisions of 780 CMR 9.00.

3404.14 Assembly Use Groups. Notwithstanding the provisions of 780 CMR 3404, Assembly Use Groups shall comply with the provisions of 780 CMR 3400.3, item 6.

3404.15 Institutional Use Groups. Notwithstanding the provisions of 780 CMR 3404.0, Institutional Use Groups shall comply with the provisions of 780 CMR 3400.3, item 7.

3404.16 Residential Use Groups. Notwithstanding the provisions of 780 CMR 3404, Residential Use Groups shall comply with the provisions of 780 CMR 3400.3, item 8.

3404.17 Fire Hazard to Adjacent Buildings. Any proposed change in the use or occupancy of an existing building which has the effect of increasing the fire hazard to adjacent buildings shall comply with the requirements of Table 705.2 for exterior wall fire resistance rating requirements, or with approved *compliance alternatives*.

3404.18 Accessibility for Persons with Disabilities. Accessibility requirements shall be in accordance with 521 CMR.

3404.19 Energy Conservation. Energy conservation requirements shall be in accordance with 780 CMR 3407.0.

3404.20 Carbon Monoxide Alarms. Carbon monoxide alarms are required and shall be selected and installed in accordance with the applicable requirements of 527 CMR and/or 248 CMR and 780 CMR 9.00.

For any building undergoing substantial renovation, CO detection shall be brought up to the Code for new construction.

780 CMR 3405.0 REQUIREMENT FOR CHANGE IN *USE GROUP* TO TWO OR MORE *HAZARD INDICES* GREATER

3405.1 General. When the existing use group is changed to a new use group of two or more hazard indices higher (as provided in Table 3403), the existing building shall conform to the requirements of the code for new construction, except as provided in 780 CMR 3408.0 or as otherwise allowed in 780 CMR 3407.0.

3405.2 Accessibility for Persons with Disabilities. Accessibility requirements shall be in accordance with 521 CMR.

3405.3 Carbon Monoxide Alarms. Carbon monoxide alarms are required and shall be selected and installed in accordance with the applicable requirements of 527 CMR and/or 248 CMR and 780 CMR 9.00. For any building undergoing substantial renovation, CO detection shall be brought up to the Code for new construction.

780 CMR 3406.0 *COMPLIANCE ALTERNATIVES*

3406.1 General. Except for structural work, where compliance with the provisions of the code for new construction, required by 780 CMR 34.00, is impractical because of construction difficulties or regulatory conflicts, *compliance alternatives* may be accepted by the building official.

Examples of *compliance alternatives* which have been used are provided in 780 CMR 120.S. The building official may accept these *compliance alternatives* or others proposed.

3406.2 Documentation. In accordance with 780 CMR 3402.1.5, the building official shall ensure that the BBRS is provided with information regarding *compliance alternatives* accepted or rejected by the *building official*.

780 CMR 3407.0 ENERGY PROVISIONS FOR *EXISTING BUILDINGS*

3407.1 General. 780 CMR 3407.0 establishes the energy provisions for *existing buildings* governed by 780 CMR 3404.0 or 780 CMR 3405.0.

3407.2Applicability. Alterations to any building component affecting the energy conservation performance of an existing building shall comply with the applicable requirements of.

(a) 780 CMR, Table 3407 and all applicable subsections of 780 CMR 13.00, or.

(b) 780 CMR 13.00 for thermal envelope requirements and all other applicable requirements of 780 CMR 13.00.

3407.3 Exempt Buildings. Refer to 780 CMR 13.00 for thermally exempt buildings and for lighting exemptions.

3407.4 Certain Specific Requirements And/or Compliance Exceptions.

3407.4.1 Fenestration. Replacement windows for existing low-rise residential buildings are required to have a maximum thermal transmittance of 0.44 and such windows must be NFRC listed/labeled.

Exceptions:

1. Criteria for NFRC listing/labeling and maximum U-0.44 are not required if the existing window (s) are true divided light (i.e. – single thickness multi-pane sashes with structural muntin bars) and being replaced with "like kind" units. This Exception additionally requires that a storm window be installed over the replacement window. The storm window may be installed internally, externally, or integrated with the primary window.
2. Criteria for NFRC listing/labeling and maximum U-0.44 are not required for basement windows with a unit height up to 24 inches, whether or not the basement is a conditioned space.

3407.4.1.1 Reduction in Wall Fenestration. When alterations to a wall assembly include only altering the fenestration component, the areas of fenestration may be decreased or replaced with an opaque wall element made to comply with the thermal transmittance value of the existing wall.

3407.4.2 *Ordinary Repairs*. *Ordinary repairs* need not comply with the energy provisions.

Note that in the repair of broken windows, broken doors or broken skylights, like-kind replacement shall be allowed, but the complete replacement of windows, doors or skylights in an *existing building* shall require compliance with the applicable requirements of 780 CMR 3407.2. Any window replacement that includes new jambs or new jamb liners does not qualify as an "ordinary repair," and such replacement is subject to the energy performance criteria of 780 CMR, 3407.2.

3407.4.3 Roofs. Compliance of the roof/ceiling assembly is not required unless the existing roofing material is stripped off the roof deck. However, if a structural analysis by a registered professional engineer shows that the roof will not support the additional live loads imposed by compliance of the roof/ceiling assembly, or, if such analysis shows that addition of the required amount of insulation will cause ponding of water, then compliance of the roof/ceiling assembly is not required.

3407.5 Alternative Designs. Alternative design methods may be used where it can be demonstrated through analysis by a licensed professional that the alternative will achieve a level of energy conservation equivalent to that required by 780 CMR 3407. A report on the energy conservation analysis shall be submitted to the building official with the application for the building permit.

TABLE 3407 COMPONENT VALUES FOR ALTERED ELEMENTS

BUILDING COMPONENT	DESCRIPTION	THERMAL PROPERTIES	NOTES
Walls	All wall construction containing heated or mechanically cooled space	U-0.08	6, 8
Foundation Walls Including Band	Containing heated or mechanically cooled space Containing unheated space	U-0.08 U-0.17	4
Roof/Ceiling Assembly	Wood plank and beam construction containing heated or mechanically cooled space	U-0.08	1
Roof/Ceiling Assembly	Construction other than wood plank and beam containing heated or mechanically cooled space	0.05	
Windows and Skylights	All construction enclosing heated or mechanically cooled space	For windows, see Note 2. For skylights - no current restriction on "U" value	2, 5 6, 7
Floors	Floor sections over area exposed to outside air or unheated areas Unheated slab on grade Heated slab on grade	U-0.08 R-5.50 R-7.75	3
Mechanical Equipment	Heating, cooling, sizing and efficiency	780 CMR 13.00	9
Equipment Controls	Humidistats, thermostats & zoning	780 CMR 13.00	9
Duct and Pipe Insulation and Construction	Located in or on buildings	780 CMR 13.00	
Electrical Power Distribution.	-	780 CMR 13.00	
Lighting	Lighting	780 CMR 13.00	

Note 1. Wood plank and beam assemblies are constructions in which the finished interior surface is the underside of the roof deck.

Note 2. For existing low-rise residential buildings, commencing January 1, 1999, the maximum allowed thermal transmittance of replacement windows, with or without a storm window, shall be 0.44 and such windows and window with storm window combinations will be NFRC listed labeled. For all other existing building types (commercial/high-rise), window thermal transmittance requirements shall conform to the requirements of 780 CMR 13.00. Refer also to 780 CMR 3407.0 Exceptions 1. and 2.

Note 3. Insulation may be omitted from floors over unheated areas when foundation walls are provided with a U value of 0.17.

Note 4. The U value requirement of 0.17 for foundation walls may be omitted when floors over unheated spaces are provided with a U value of 0.08.

Note 5. Refer to 780 CMR 13.00 and 61.00, as applicable for allowable air infiltration rates for residential doors and windows. Allowable rate for commercial doors is 11 cfm/lin. ft of operable sash crack.

Note 6. The first floor exterior envelope of business and mercantile use groups shall have an overall thermal transmittance value not greater than .65 in lieu of individual component values for walls and fenestration.

Note 7. When the glass area is increased, the glass and wall components which are altered shall comply with the component values in Table 3407. The extent of wall made to comply shall be equivalent to the decreased opaque wall area.

Note 8. When any alterations to the exterior wall component exposes the wall cavity or, when a finished system is added to a wall having no cavity, the wall must comply with the values in Table 3407.

Note 9. When mechanical system compliance is required on an existing system, only the portions of the system altered and any other portions which can reasonably be incorporated need comply.

780 CMR 3408.0 STRUCTURAL REQUIREMENTS FOR EXISTING BUILDINGS

3408.1 General Requirements.

3408.1.1 Basic Requirement. The structural work for alterations, repairs, and additions to existing buildings shall be designed and constructed in accordance with the Code requirements for new construction for the loads specified in 780 CMR 3408.0, except as otherwise provided in 780 CMR 3408.0.

3408.1.2 Prior Building Codes. The structural systems of existing buildings shall, as a minimum, conform to the basic code. Structural systems and elements that do not so comply shall be reinforced so that they do so comply or, alternatively, so that they comply with the requirements for new construction of 780 CMR .

3408.1.3 Structurally Separate Additions. Additions to existing buildings which are structurally separate therefrom shall comply with the requirements for new construction.

3408.1.4 Structurally Separate Portions of Existing Buildings. Where portions of an existing building are structurally separate, each portion shall be considered a separate building for the purposes of 780 CMR 3408.0.

3408.2 Definitions.

Basic Code. The building code in-force on the date of the application for the building permit for the original building. If subsequent changes have been made to the lateral force resisting system of the building and the changed lateral force resisting system conforms to the requirements for new construction of the building code in-force on the date of the application for the building permit for said changes, the basic code shall be the building code for the latest of such structural changes.

Box System. Term used in the seismic provisions of the 1st to 5th Editions of the State Building Code. The meaning is the same as *Wall System, Bearing* as defined in ASCE 7, Section 9.2.1.

Cladding. Elements of the building envelope at the sides of a building which do not support any gravity load other than their own weight and are not designed to resist imposed in-plane forces.

Dual Bracing System. Term used in the seismic provisions of the 1st to 5th Editions of the State Building Code. The meaning is the same as *Frame System, Dual frame system*, as defined in ASCE 7, Section 9.2.1.

Effective Seismic Weight. Effective seismic weight shall be as defined by 780 CMR 1615.0, except as provided in 780 CMR 3408.4.1.

Space Frame. Term used in the seismic provisions of the 1st to 5th Editions of the State Building Code. The meaning is the same as *Frame System, Space frame system*, as defined in ASCE 7, Section 9.2.1. (Used in definition of *Frame System, Building frame system* in ASCE 7, Section 9.2.1).

Structural Engineer of Record (SER). A *registered design professional* qualified in the structural design of buildings who is responsible for the structural engineering design of a construction project and whose professional seal and signature appear on the structural design documents submitted with the application for building permit.

URM. Unreinforced masonry.

3408.3 Classification of Existing Buildings.

Post-1975 - Buildings whose basic code has an effective date on or after January 1, 1975. (Governed by 780 CMR, the Massachusetts State Building Code).

Pre-1975 - Buildings whose basic code has an effective date prior to January 1, 1975, or for which there was no building code. (Prior to 780 CMR, the Massachusetts State Building Code).

3408.4 Levels of Work on Existing Buildings.

The work involved in alterations, repairs, and additions to existing buildings, and changes of use of existing buildings, shall be classified as described in 780 CMR 3408.4. For an existing building where more than one level of work applies, the requirements for the highest level of work shall apply.

3408.4.1 Explanation of Terms. The explanation of terms that follow are for the purposes of classifying the levels of work in 780 CMR 3408.4 and for use in Figure 3408-1, only.

1. Floor or roof area shall be measured to the inside face of exterior masonry or concrete walls, to the inside face of exterior wood stud walls, or to the inside face of the principal framing members of curtain walls.
2. *Effective seismic weight* shall include only that effective seismic weight above mean exterior grade, exclusive of slabs on grade, foundation walls, and framed floors that are laterally braced by foundation walls.
3. Effective seismic weight of existing buildings previously used for storage or manufacturing. For the purpose of determining the seismic weight before any renovations, the following allowances shall be used in lieu of both the 25% of storage live load and the operating weight of equipment. 30 psf of floor area if the unreduced live load capacity of the floor is 100 psf or more; 20 psf of floor area if the unreduced live load capacity of the floor is less than 100 psf but at least 80 psf; or zero, otherwise. Neither a partition allowance nor the weight of any in-place partitions shall be

included if any of these allowances are taken, except when zero is used.

3408.4.2 Level 1 Work. Work that is not specified for Levels 2, 3, 4, or 5.

3408.4.3 Level 2 Work. Work or change of use involving any of the following.

1. Change of use of an area which is more than 35% of the existing floor area of the building.
2. For Pre-1975 buildings, when rehabilitation or remodeling is accumulated over a floor area of 20,000 sf or 50% of the total floor area of the building, whichever is less, starting from January 1, 2007. The terms rehabilitation and remodeling for the purposes of this clause shall mean any of the following work. removal or repair of ceilings, partitions, or interior facing of exterior walls; new ceilings, partitions, or interior facing of exterior walls; reconstruction or repair of floors; new mechanical or electrical distribution systems within an area; or new elevators, escalators, or stairs within an area or serving an area.
3. Increase in total framed floor and roof area due to structurally attached additions up to a lifetime limit of 10% of the total framed floor and roof area of the building that existed on February 28, 1997, or on the date of the certificate of occupancy if the building was built thereafter.
4. Increase in effective seismic weight, with or without structurally attached additions, up to a lifetime limit of 10% of the effective seismic weight of the building that existed on February 28, 1997, or on the date of the certificate of occupancy if the building was built thereafter.
5. Structural work involving any of the following.
   A. More than 25% of the total tributary area of horizontal framing members or 20,000 sf of tributary area of horizontal framing members, whichever is less, of any existing framed floor or roof.

   B. More than 25% of the total area of shear walls above the foundation.

   C. More than 25% of the total length of columns and diagonal braces.

   D. Openings in any framed floor or roof that have an area more than 5% of the area of the framed floor or roof.

   E. Changes to any structural wall that reduce its in-plane shear resistance by more than 15%.

   F. Changes to any floor or roof diaphragm that reduce its in-plane shear resistance by more than 15%.

   G. Removal or reconfiguration of lateral load resisting frames, or foundations supporting them.
6. **Exemption for Pile Foundations.** Structural repairs of pile foundations are exempt from Level 2 Work.

3408.4.4 Level 3 Work. Structural work involving any of the following:

1. Removal, or removal and reconstruction, of between 15% and 40% of the total tributary area of horizontal framing of existing framed floors and roofs.

   Exception. Demolition of a previous addition to the building; demolition of an appendage to the building such as a loading dock outside of the exterior wall line; or demolition of a mechanical penthouse; with the condition that the demolition does not reduce the existing lateral load resistance of the remaining portion of the building below that provided before demolition.
2. New shear walls and vertical frames which provide more than 35 % of the lateral force resistance required for Level 2 Work, in either of two orthogonal directions.

3408.4.5 Level 4 Work. Work involving any of the following.

1. Increase in total framed floor and roof area due to structurally attached additions that is more than 10% of the total framed floor and roof area of the building that existed on February 28, 1997, or on the date of the certificate of occupancy if the building was built thereafter.
2. Increase in effective seismic weight, with or without structurally attached additions, that is more than 10% of the effective seismic weight of the building that existed on February 28, 1997, or on the date of the certificate of occupancy if the building was built thereafter.

3408.4.6 Level 5 Work. Work involving any of the following.

1. The removal, or the removal and reconstruction, of more than 40% of the total tributary area of horizontal framing of existing framed floors and roof.

   Exception. Demolition of a previous addition to the building; demolition of an appendage to the building such as a loading dock outside of the exterior wall line; or demolition of a mechanical penthouse; with the condition that the demolition does not reduce the existing lateral load resistance of the remaining portion of the building below that provided before demolition.
2. Structurally attached additions that have a total framed floor and roof area greater than 100% of the total framed floor and roof area of the building that existed on February 28, 1997, or on the date of the certificate of occupancy if the building was built thereafter.
3. Increase in effective seismic weight, with

or without structurally attached additions, that is more than 100% of the effective seismic weight of the building that existed on February 28, 1997, or on the date of the certificate of occupancy if the building was built thereafter.

4. New shear walls and vertical frames which provide more than 90% of the lateral force resistance required for Level 3 Work, in either of two orthogonal directions.

3408.5 Restricted Uses.

3408.5.1 Restricted Uses Defined. For the purposes of 780 CMR 3408.0, restricted uses shall be as follows:

1. Assembly Groups A-1 and A-2 for an occupant load of 600 or more.
2. Assembly Group A-3 for an occupant load of 1200 or more.
3. Assembly Groups A-4 and A-5 for an occupant load of 600 or more.
4. Hazardous Group H.
5. Institutional Group I-2 for an occupant load of 400 or more.
6. Institutional Group I-3.
7. Buildings in Seismic Use Group III, as defined in ASCE, Table 9.1.3.

3408.5.2 Change of Use and Work for Restricted Uses. Change of use of an existing building to a restricted use, or work above Level 2 for existing buildings with restricted uses, shall comply with the requirements for Level 5 Work.

3408.6 Structural Investigation of Existing Buildings.

3408.6.1 Level 1 Work.

3408.6.1.1 Responsibility of the SER. Whenever there is any structural work for Level 1 Work, the SER shall perform the following tasks.

1. Verify that the work to be performed is in fact Level 1 Work.
2. Make a field investigation of the areas and structural members affected by the proposed structural work.
3. Evaluate the capacity of existing structural elements affected by the proposed structural work.

3408.6.1.2 Responsibility of the Architect. The architect of record shall verify that the changes to the existing building are in fact Level 1 Work, and so certify on the construction drawings.

3408.6.2 Levels 2, 3, 4, and 5 Work.

3408.6.2.1 Initial Survey of Existing Building. The SER shall make an initial survey of the existing building consisting of the following tasks. Alternatively, a registered architect, who will be the architect of record for the project, may substitute for the SER for the parts of the investigative work that do not require a structural evaluation.

1. Gather and catalog relevant available information on the existing building, such as drawings, specifications, shop drawings, geotechnical engineering reports, previous condition appraisal reports, and building department records.
2. Perform a field survey to either verify the available drawings or to establish dimensions of the existing building, including layout and sizes, of relevant structural components.
3. Perform a field survey to visually assess the condition of the structural components of the existing building.
4. Identify load paths (or lack thereof) to the foundation for gravity load and lateral load, based on information gathered in the above tasks.

3408.6.2.2 Foundation and Geotechnical Explorations.

3408.6.2.2.1 Level 2 Work. If the work does not involve an addition or does not include an increase in gravity loads, and does not involve new shear walls or vertical frames or reinforcement of existing shear walls or vertical frames to resist the lateral loads required in 780 CMR 3408.7.3, and if there is no indication of settlement or lateral movement of basement walls or foundations, no foundation or geotechnical exploration is required. Otherwise, explorations shall be performed as necessary to determine the foundation design parameters of the subsoils and the type and condition of existing foundations.

3408.6.2.2.2 Levels 3, 4, and 5 Work. Explorations shall be performed as necessary to determine the foundation design parameters of the subsoils, the type and condition of existing foundations, and the potential for liquefaction of soils during an earthquake where required in 780 CMR 3408.9.11.

3408.6.2.3 Structural Evaluation of the Existing Building.

3408.6.2.3.1 Existing Structural Materials. The SER shall determine the strengths of existing structural materials in accordance with 780 CMR 3408.9.2.3 and 3408.9.2.4.

3408.6.2.3.2 Repairs. The SER shall evaluate structurally hazardous conditions and determine which existing structural elements or systems are in need of repair or other remedial action, and determine the character and extent of the repairs or remedial action.

3408.6.2.3.3 Gravity Load Capacity -

Level 2 Work. Where there are structural changes to floors or roofs, the SER shall determine the total service load capacity, and the net unreduced service live load capacity or the net service snow load capacity, as applicable, in the affected areas.

3408.6.2.3.4 Gravity Load capacity - Levels 3, 4, and 5 Work. The SER shall determine the total service load capacity of the floors and roofs, the net unreduced service live load capacity of the floors, and the net service snow load capacity of the roofs.

3408.6.2.3.5 Lateral Load Capacity - Levels 2, 3, 4, and 5 Work. The SER shall determine the lateral load capacity of the existing building and its lateral load components relative to the lateral load resistance required for the level of work to be performed, and determine what is needed to provide the required lateral load resistance.

3408.6.2.4 Structural Details. The SER shall evaluate the following details.

1. Connectivity of the structural elements.
2. Existence of anchors connecting floor and roof decks to concrete or masonry walls, and if they exist, their ability to provide lateral support to the walls and transfer in-plane shear from the decks to the plane of the walls.
3. Existence of unreinforced masonry parapets, how they are supported at the roof diaphragm, their height measured from the roof diaphragm, and their thickness.
4. For masonry walls, the ratio of the distance between lateral supports to the thickness of wall.
5. Existence of brittle connections of precast concrete cladding components.

3408.6.3 Report on Structural Investigation. The SER shall submit a report on his structural investigation to the building official with the application for the building permit.

3408.6.4 Condition of Permit. The submission of the SER's report on his structural investigation and review thereof by the building official shall be a condition for the issuance of the building permit. The building official shall maintain this report for future renovations of the building.

3408.6.5 Field Observations During Construction. The SER shall make periodic field visits during the progress of the construction work on the existing building in order to observe and verify the assumed conditions on which the structural design was based, and shall modify the design, as necessary, should the observed conditions differ in any significant manner from those on which the structural design was based. The SER shall provide a written notification to the building official of changes to the contract documents submitted with the application for building permit.

3408.7 Lateral Load for Existing Buildings and Structurally Attached Additions.

3408.7.1 Application of Lateral Load. Where the work includes structurally attached additions to an existing building, the specified lateral loads in 780 CMR 3408.7 shall be applied to the existing building and additions acting together as a single structure.

3408.7.2 Level 1 Work. There are no requirements for lateral load for Level 1 Work.

3408.7.3 Level 2 Work. For Level 2 Work, each of the following lateral loads shall be applied to the building separately:

1. ⅔ of the wind load specified in 780 CMR 1609.0.
2. A lateral load in any direction which is 1% of the unfactored gravity load for Allowable Stress Design or 1.5% of the unfactored gravity load for Strength Design, distributed the same as the gravity load. For the purposes of this clause only, the gravity load shall be defined as D + 0.5S, where the notation is as defined in 780 CMR 16.00.
3. The wind load specified in the basic code, if any.
4. For Post-1975 buildings, the seismic load in accordance with the seismic provisions for new buildings of the basic code.

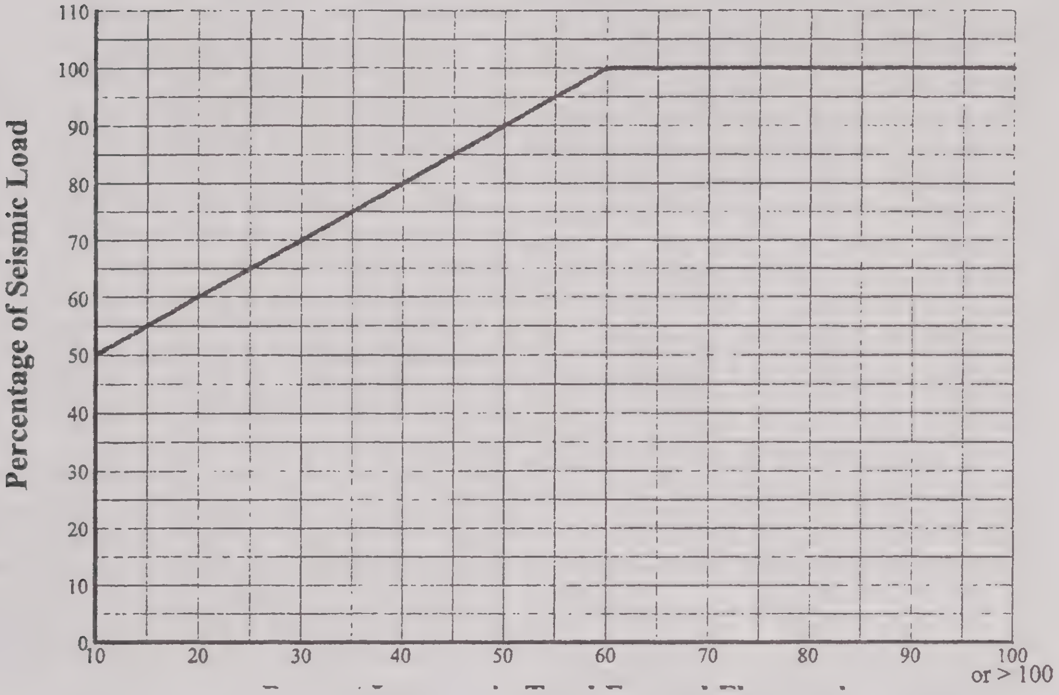
3408.7.4 Level 3 Work. For Level 3 Work, each of the following lateral loads shall be applied to the building separately:

1. The wind load specified in Section 1609.
2. 35% of the seismic load specified in 780 CMR 1614.0 and 1615.0, in accordance with the seismic criteria of 780 CMR 1614.0, 1615.0, and 3408.10, with a minimum seismic base shear of 0.01W.
3. For Post-1975 buildings, the seismic load in accordance with the seismic provisions for new buildings of the basic code.

3408.7.5 Level 4 Work. For Level 4 Work, each of the following lateral loads shall be applied to the building separately:

1. The wind load specified in 780 CMR 1609.0.
2. A percentage, given in Figure 3408-1, of the seismic load specified in 780 CMR 1614.0 and 1615.0, in accordance with the seismic criteria of 780 CMR 1614.0, 1615.0, and 3408.10. In Figure 3408-1, the meaning of the term *effective seismic weight* in the title of the abscissa shall be in accordance with Clauses 3408.4.1, Items 2. and 3.
3. For Post-1975 buildings, the seismic load in accordance with the seismic provisions for new buildings of the basic code.

FIGURE 3408.1 PERCENTAGE OF THE SEISMIC LOAD SPECIFIED IN 780 CMR 1614.0 AND 1615.0



3408.7.5.1 Buildings Designed for Additional Stories. For Post-1975 buildings which have been designed for additional stories, the seismic load and seismic criteria for new buildings of the basic code may be used in lieu of the criteria in 780 CMR 3408.7.5 , Items 2. and 3., with the following conditions:

1. The building (or an addition for which provision was made for the additional stories) was constructed under a building permit whose date is not more than 15 years prior to the date of the application for a building permit for the additional stories.
2. The number of additional stories shall not be more than the number of additional stories provided for in the original design.
3. The size of any story shall not be larger than the footprint of the story immediately below. For partial stories, account shall be taken of torsion induced by the eccentricity.
4. For buildings whose basic code was prior to the 6th Edition of the State Building Code and have rigid or semi-rigid diaphragms, new shear walls or frames shall be located as necessary such that the eccentricity of the shear center at each level from the center of mass at that level is not more than 20% of the building width in each of two orthogonal directions. Alternatively, new shear walls or frames shall be located as necessary so that the building complies with ASCE 7, Section 9.5.5.5.2, as modified by 780 CMR 1615.0. The mass at any level shall be all of the mass of the building at and above that level.
5. Buildings whose basic code was prior to the 6th Edition of the State Building Code and which have weak stories, as defined in ASCE 7, Table 9.5.2.3.3, shall be reinforced as necessary so that the building meets the criteria of ASCE 7, Section 9.5.2.6.2.4.

3408.7.6 Level 5 Work. For Level 5 work, each of the following lateral loads shall be applied to the building separately.

1 The wind load specified in 780 CMR 1609.0.

2 The seismic load specified in 780 CMR 1614.0 and 1615.0, in accordance with the seismic criteria of 780 CMR 1614.0 and 1615.0.

3408.7.7 Historic Buildings. House museums are exempt from the lateral load requirements of 780 CMR 3408.7. Preserved historic buildings shall meet all of the lateral load requirements of 780 CMR 3408.7.

3408.8 Gravity and Other Loads for Existing Buildings and Structurally Attached Additions.

3408.8.1 Live Load. Live load shall be in accordance with 780 CMR 1607.0, with the following exceptions:

3408.8.1.1 Reduced Live Load. Except for Use Groups, F, I, and S, wherever there is a new use in an existing building, and the new use requires a live load in accordance with

780 CMR 1607.0 that is greater than the original live load capacity, the floors may be posted for the original live load capacity, provided that the use is controlled in a way acceptable to the building official, and so that the public safety is not endangered thereby.

3408.8.1.2 Level 1 Work. Level 1 Work is exempt from the live load requirements of 780 CMR 1607.0 except in areas being altered or repaired.

3408.8.2 Snow Load. Snow load shall be in accordance with 780 CMR 1608.0, with the following exceptions.

3408.8.2.1 Ground Snow Load. For determining snow loads on existing buildings, ground snow load may be reduced to 85% of that required by 780 CMR 1608.0. There shall be no reduction of ground snow load for additions, or for drift loads on existing buildings created by higher additions.

3408.8.2.2 Level 1 Work. Level 1 Work is exempt from the snow load requirements of 780 CMR 1608.0, except for snow drift loads due to new roof top equipment or structures.

3408.8.2.3 Historic Buildings. House museums are exempt from the snow load requirements of 780 CMR 3408.8.2.

3408.8.3 Lateral Soil and Hydrostatic Loads. For additions, lateral soil and hydrostatic loads shall be in accordance with 780 CMR 18.00. There are no requirements for lateral soil and hydrostatic loads for existing basement or foundation walls provided said walls and the structure supporting them laterally do not exhibit structural distress due to lateral soil or hydrostatic load; otherwise, lateral soil and hydrostatic loads shall be in accordance with 780 CMR 18.00.

3408.8.4 Flood Loads. Flood load shall be in accordance with 780 CMR 1612.0 for Level 4 and Level 5 Work. There are no flood load requirements for Levels 1, 2, and 3 Work.

3408.8.5 Dead Loads. Dead loads shall be in accordance with 780 CMR 1606.0.

3408.9 Structural Design and Construction.

3408.9.1. Stiffness and Deflection Control. For Levels 2, 3, 4, and 5 Work, except for Level 2 Work where there are no changes to the existing lateral load resisting system, the building design shall comply with the following deflection criteria.

1. For seismic load on buildings with URM bearing or enclosure walls, the maximum inelastic story drift in the direction of the seismic load shall not exceed 0.007h, where h is the story height. Inelastic story drift shall be calculated in accordance with ASCE 7, Section 9.5.5.7 or 9.5.6.6, except that the drift determination shall be made for each shear wall and vertical frame. The drift of URM bearing or enclosure walls perpendicular to the direction of the seismic load shall not exceed 0.010h.
2. For wind load, or the lateral load defined in 780 CMR 3407.7.3, Item 2., on buildings with URM bearing or enclosure walls, the maximum story drift at each shear wall and vertical frame shall not exceed 0.002h. The drift of URM bearing or enclosure walls perpendicular to the direction of the lateral load shall not exceed 0.0025h. These values apply to unfactored load levels.
3. For seismic loads on buildings without URM bearing or enclosure walls, the maximum inelastic story drift shall be calculated in accordance with ASCE 7, Section 9.5.5.7 or 9.5.6.6.

3408.9.1.1 Reinforced Concrete Moment Frames. For seismic load on existing reinforced concrete moment frames of Pre-1975 buildings, including flat slab or flat plate buildings, whether supplemented with new lateral load resisting elements or not, the inelastic story drift shall not exceed 0.01 times the story height.

3408.9.2 Existing Structural Members and Systems.

3408.9.2.1 Strength of Existing Structural Members and Systems. Strength of existing systems, members, and connections shall be determined in accordance with the Code requirements for new construction and currently accepted engineering practice, using the actual strength and other physical properties of the existing materials, except as provided in 780 CMR 3408.9.2.2. and 3408.9.2.4.

3408.9.2.2 Compliance with Previous Codes. For evaluating capacity of existing structural systems, members, or connections for compliance with the basic code, structural design codes and standards in effect at the time of the basic code may be used.

3408.9.2.3 Strength of Materials. The strength of existing materials shall be determined by tests or from generally accepted historical records.

3408.9.2.4 Archaic Materials. Strength of existing systems, members, and connections made from materials no longer produced (archaic materials) may be evaluated from the archaic material codes and engineering practices at, or later than, the time said existing systems and elements were constructed. Existing systems and elements made from archaic materials shall not be used to resist seismic load.

3408.9.2.5 Deficient or damaged structural members. Existing structural members or their connections that are found to be deteriorated or damaged, either prior to or during an alteration or addition, shall be repaired, replaced, or reinforced. Existing structural members shall be considered deteriorated or damaged if their capacity is less than 85% of their original strength. Repairs, replacement, or reinforcement shall be in accordance with currently accepted engineering practice.

3408.9.2.6 Reuse of Existing Structural Members. Existing structural members in sound structural condition may be reused.

3408.9.3 Sheathing for Light-framed Shear Walls. The following types of existing sheathing over light-framed wood walls may be used to resist in-plane shear, where the walls are anchored to floors and to the floor or roof construction above such that they can transfer the shear between stories and to the foundation. wood structural panels, diagonal boards, wood siding over horizontal or diagonal boards, plaster on wood or metal lath, and stucco on metal lath. Gypsum sheathing, lath, wall board, and drywall; fiberboard; and particle board are not permitted for resisting in-plane shear.

Exception. Existing gypsum sheathing, lath, wall board, and drywall; fiberboard; and particle board may used to resist in-plane shear if originally designed in accordance with 780 CMR for that purpose.

3408.9.4 Connections of Lateral Load Resisting Frames and Walls to Diaphragms. For Levels 2, 3, 4, and 5 Work, all vertical lateral load resisting frames and shear walls (including all masonry and concrete enclosure, bearing, and fire walls) shall be connected to floor and roof diaphragms. The connections shall resist the in-plane forces between diaphragms and vertical frames, and between diaphragms and shear walls. The connections shall also resist imposed forces that are transverse to the vertical frames and shear walls. The in-plane and transverse design forces for these connections shall not be less than 190 lbs per foot for Allowable Stress Design or 280 lbs/foot for Strength Design.

3408.9.5 Shear Walls and Frames for Levels 2, 3, 4, and 5 Work.

3408.9.5.1 Distribution of Lateral Load with Flexible Diaphragms. For buildings with flexible diaphragms, such as wood floor and roof decks or unfilled metal roof decks, and with masonry or concrete shear walls or steel braced frames, the lateral load from each level shall be proportioned to shear walls and braced frames in accordance with their tributary width perpendicular to the load, unless a different distribution is justified by a lateral load analysis which accounts for the flexibility of the diaphragms and the stiffnesses of the shear walls and frames.

3408.9.5.2. Lines of Shear Walls or Frames with Flexible Diaphragms. For buildings or portions of buildings with flexible diaphragms, such as wood floor and roof decks or unfilled metal roof decks, there shall be a minimum of two lines of shear walls or frames to resist lateral load in each orthogonal direction (or the equivalent), located at or as close as practicable to the opposite sides of the building or portion of the building.

3408.9.5.3 Ductility Requirements for New Shear Walls and Frames. For Level 2 Work, where new shear walls or frames are required, said frames and shear walls shall be detailed in accordance with the seismic requirements of 780 CMR 19.00, 21.00., 22.00, or 23.00, as applicable. The new frames and shear walls shall be one of the types permitted in ASCE 7, Table 9.5.2.2, as revised by 780 CMR 1615.0.

3408.9.6 Row Buildings.

3408.9.6.1 Party Walls. A party wall is defined as a wall on a lot line owned in common by the two abutters. For the purposes of 780 CMR 3408.9.6, where a wall is on one side of a lot line and owned by one of the abutters, and the face of that wall nearest the lot line is within two inches of the lot line, the wall shall be considered to be a party wall.

3408.9.6.2 Lateral Resistance Parallel to Front and Rear Walls. When lateral load resistance of an existing building within a row of buildings with party walls is to be determined, said resistance parallel to the front and rear walls shall be the resistance of the entire row of buildings.

3408.9.6.3 Maintaining lateral load resistance. When an existing building within a row of buildings with party walls is altered, demolished, or replaced, the lateral load resistance and stiffness parallel to the front and rear walls contributed by the existing building to the row of buildings shall be maintained or replaced.

3408.9.6.4 Lateral Support of Party Walls. Where a building within a row of buildings is removed or partially removed, the party walls on each side of the removed structure shall be laterally supported by means other than friction.

3408.9.6.5 New buildings. New structures that replace an existing building in a row of buildings shall not impose lateral forces on the other buildings in the row in excess of what the existing building could have imposed.

3408.9.7 Precast Concrete Cladding Connections B Levels 4 and 5 Work. Connections of existing precast concrete cladding elements for Levels 4 and 5 Work shall be made to conform to the requirements of 780 CMR 1615.0.

3408.9.8 Special Requirements for URM Walls.

3408.9.8.1 Lateral Support. For Levels 2, 3, 4, and 5 work, the ratio of distance between lateral supports to the nominal thickness of wall shall be 18 or less; otherwise the walls shall be strongbacked. Strongbacks shall be designed to resist the full transverse (out of plane) design load on the URM walls, with a maximum transverse displacement of 1/600 of the distance between lateral supports. In ASCE 7, Equation 9.6.1.3-1, a_p shall be taken as 1.0 and R_p shall be taken as 1.5 for URM walls.

3408.9.8.2 Tying Back Parapets. For Levels 2, 3, 4, and 5 Work, the top of masonry parapets extending from URM walls with a height to thickness ratio of more than three shall be tied back to the roof. The height of parapet shall be measured from the level of where the URM walls are connected to the roof diaphragm.

3408.9.8.3 New Buildings Using Existing Masonry Facades. Existing URM facades may be used to enclose new buildings provided:

1. that the walls are laterally supported by the new building in such a way that there is no imposed in-plane shear transferred to the facade from the building;
2. that seismic load induced into the plane of the walls due to their own mass can be resisted by the respective walls; and
3 that the walls conform to the criteria of 780 CMR 3408.9.8.1 and 3408.9.8.2.

3408.9.9 Limits to Vertical Additions Having URM or Unreinforced Concrete Bearing Walls. For Level 4 Work, structurally attached vertical additions to existing buildings having URM or unreinforced concrete bearing or enclosure walls shall be limited as follows:

1. Only a lifetime one story is permitted to be added to one and two story buildings, and no vertical addition is permitted for buildings with more than two stories.
2. The area of the permitted vertical addition shall not exceed the footprint of the uppermost existing floor.

Exception. There is no limit to the number of stories of a vertical addition if the addition has a new lateral load resisting system such that lateral loads on the addition are not imposed on the existing URM walls, and if no additional gravity load is imposed on the existing URM walls.

3408.9.10 Seismic design with URM and unreinforced concrete shear walls.

3408.9.10.1 Uncracked Shear Walls. Existing URM and unreinforced concrete shear wall elements acting with a new lateral load resisting system shall be considered to remain uncracked during the design earthquake when the calculated in-plane seismic shear force on the elements multiplied by the system overstrength factor (Ω_o) of the new lateral load resisting system is less than or equal to the shear capacity of the elements.

3408.9.10.2 Levels 3 and 4 Work. When the in-plane seismic shear force in a URM or unreinforced concrete shear wall, calculated in accordance with the design coefficients in Table 3408-1, exceeds the in-plane shear capacity, a new lateral load resisting system of a type permitted in ASCE 7, Table 9.5.2.2, as revised by 780 CMR 1615.0, shall be added to the building to resist the seismic load. The new lateral load resisting system shall be designed to act with existing shear wall elements that remain uncracked in accordance with 780 CMR 3408.9.10.1, accounting for the relative stiffness of the new elements and the uncracked existing shear wall elements, using as an R factor the R factor for the new lateral load resisting system.

3408.9.10.3 Level 5 Work. The primary lateral load resisting system, in accordance with 780 CMR 3408.7.6, Item 2., shall be designed to resist seismic load independent of the URM or unreinforced concrete shear walls. The primary lateral load resisting system shall also be designed to interact with existing shear wall elements that remain uncracked in accordance with 780 CMR 3408.9.10.1, accounting for the relative stiffness of the elements of the primary system and the uncracked existing shear wall elements, using as an R factor the R factor for the primary lateral load resisting system.

3408.9.11 Liquefaction of Underlying Soils. For additions in Level 4 or Level 5 Work, the potential for liquefaction shall be considered in accordance with 780 CMR 1804.6.

3408.10 Supplementary Seismic Provisions for Existing Construction. Where seismic resistance is required in 780 CMR 3408.0, existing lateral force resisting systems that are not permitted in 780 CMR 1615.0 may be used for seismic resistance in accordance with the following requirements.

3408.10.1 Limitation. 780 CMR 3408.10 does not apply to Level 5 Work.

3408.10.2 Design Coefficients and Factors. Values of the Response Modification Coefficient, R, System Over-strength Factor, Ω_o, and the

Deflection Amplification Factor, C_d, for systems not permitted in 780 CMR 1615.0 shall be in accordance with Table 3408-1. Except as provided in Table 3408-1, there are no seismic design or detailing rules for the systems listed in the table.

TABLE 3408-1 DESIGN COEFFICIENTS AND FACTORS FOR SEISMIC FORCE RESISTING SYSTEMS NOT PERMITTED IN 780 CMR 1615.0

Basic Seismic Force Resisting System[1]	Respense Modification Coefficient, R	System Overstrength Factor, Ωo	Deflection Amplification Factor, Cd
Bearing Wall Systems			
Steel concentrically braced frame (CBF) with diagonal[3] or X-bracing			
CBF per 6th Ed SBC[2] except AISC 1992 Seismic Provisions, Sect 9.5	3.5	2	3.5
Otherwise[4]	3	3	3
Steel CBF with V, inverted V, or K bracing			
V or Inverted V bracing per 6th Ed. SBC[2]	3	3	3
V or Inverted V bracing, otherwise[4]	3	3	3
K bracing	1.25	1.25	1.25
Reinforced concrete shear walls with boundary elements and without coupling beams, in accordancre with 780 CMR 1113.5.1.4a, 5th Ed.	5	2.5	5
Reinforced concrete shear walls with reinforcing steel less than required by, or spaced further apart than, that required in ACI 318, Sec. 11 10.9	1.5	1.5	1.5
Unreinforced concrete shear walls	1.25	1.25	1.25
Reinforced masonry shear walls classified in accordance with 780 CMR 3408.10.2.1			
Class A	4.5	2.5	3.5
Class B	2.25	2.25	2.25
Class C	1.25	1.25	1.25
Unreinforced masonry shear walls	1.25	1.25	1.25
Light-framed walls sheathed with wood structural panels or diagonal sheathing	4	2.5	3
Other light-framed walls sheathed with materials permitted in 780 CMR 3408.10.6	2	2	2
Building Frame Systems			
Steel concentrically braced frame (CBF) with diagonal[3] or X-bracing			
CBF per 6th Ed SBC[2] except AISC, 1992 Seismic Provisions, Sect 9.5	4	2	3.5
Otherwise[4]	3	3	3
Steel CBF with V, inverted V, or K bracing			
V or Inverted V bracing per 6th Ed. SBC[2]	3	3	3
V or Inverted V bracing, otherwise[4]	3	3	3
K bracing	1.5	1.5	1.5
Reinforced concrete shear walls with boundary elements and without coupling beams, in accordancre with 780 CMR 1113.5.1.4a, 5th Ed.	6	2.5	5
Reinforced concrete shear walls with reinforcing steel less than required by, or spaced further apart than, that required in ACI 318-02, Sec. 11.10.9	1.5	1.5	1.5
Unreinforced concrete shear walls	1.5	1.5	1.5
Reinforced masonry shear walls classified in accordance with 780 CMR 3408.10.2.1			
Class A	5	2.5	4
Class B	2.25	2.25	2.25
Class C	1.5	1.5	1.5
Unreinforced masonry shear walls	1.5	1.5	1.5
Light-framed walls sheathed with wood structural panels or diagonal sheathing	4	2.5	3
Other light-framed walls sheathed with materials permitted in 780 CMR 3408.10.6	2.5	2.5	2.5

TABLE 3408-1 DESIGN COEFFICIENTS AND FACTORS FOR SEISMIC FORCE RESISTING SYSTEMS NOT PERMITTED IN 780 CMR 1615.0 - continued

Basic Seismic Force Resisting System[1]	Respense Modification Coefficient, R	System Overstrength Factor, Ωo	Deflection Amplification Factor, Cd
Moment Resisting Frame Systems			
Steel moment frames			
Special Moment Frame per 6th Ed. SBC[2]	8	3	5.5
Ordinary Moment Frame per 6th Ed. SBC[2]	3.5	3.5	3.5
Moment frame, otherwise[4]	3	3	3
Reinforced concrete moment frames classified in accordance with 780 CMR 3408.10.2.2			
Class A	5	3	4.5
Class B	2.5	2.5	2.5
Dual Systems (See ASCE 7, Section 9.5.2.2.1)			
Steel concentrically braced frame (CBF) with steel moment frames (MF)			
CBF and Special MF, per 6th Ed. SBC[2]	5	2.5	4.5
CBF and MF, per 1st-5th Ed. SBC[2], except V, Inverted V, or K Bracing	3.5	2.5	3.5
CBF and MF, per 1st-5th Ed. SBC[2], with V or Inverted V Bracing	3	2.5	3
Otherwise	1.5	1.5	1.5
Reinforced concrete shear walls with boundary elements and without coupling beams, in accordancre with 780 CMR 1113.5.1.4a, 5th Ed., with reinforced concrete moment frames in accordance with 780 CMR 3408.10.2.2, Class A.	6	2.5	5
Ordinary reinforced concrete shear wall, as defined in 7th Ed. SBC, with reinforced concrete moment frames in accordance with 780 CMR 3408.10.2.2, Class A	5.5	2.5	4.5

Notes:

1. Systems of previous editions of the State Building Code that meet the ductility requirements of the 7th Edition of the Code are not included in this table.
2. SBC = State Building Code.
3. A diagonal brace is one that frames from a beam to column connection diagonally to another beam to column connection or to a column at its base plate.
4. The seismic resistance of the frame shall be based on its seismic connections being subject to two times the computed forces and moments resulting from seismic load.

3408.10.2.1 Classification of Reinforced Masonry. Existing reinforced masonry shear walls shall be classified for Table 3408-1, as follows:

Class A Minimum total cross-sectional area of reinforcement in the vertical and horizontal direction is 0.002 times the gross cross-sectional area of wall, with a minimum in each direction of 0.0007 times the gross cross-sectional area of wall. Maximum spacing of reinforcing steel bars in grouted cells or bond courses is 6'-0" in one direction and 4'-0" in the other direction, but not less than ⅓ of the length or height of the wall, whichever is smaller, in each direction. Otherwise meets requirements for reinforced masonry of the basic code.

Class B Same as Class A, except spacing limits for the reinforcing steel bars are exceeded.

Class C Less than the minimum cross-sectional area of reinforcement required for Class A.

3408.10.2.2 Classification of Reinforced Concrete Moment Frames. Existing reinforced concrete moment frames shall be classified for Table 3408-1, as follows:

Class A Design in accordance with 780 CMR 1113.5.1, 1113.5.1.1, 1113.5.1.2 and 1113.5.1.3, 5th Edition; and ACI318-83, Sections 11.12.1.1 and 11.12.1.2 for reinforcing of the beam-column joints.

Class B Does not meet all the requirements for Class A.

3408.10.3 Alternate Methods of Analysis and Design. In lieu of the requirements of 780 CMR 1615.0 and 780 CMR 3408.10.2, analysis and design for existing buildings may be in accordance with SEI/ASCE 31 for the loading specified in 780 CMR 1614.0, except that sheathing over light-framed wood walls that is not permitted in 780 CMR 3408.9.3 shall not be used to resist in-plane shear for shear walls, and wood foundations other than piles and poles shall not be used to resist any load. The SER shall document the use of SEI/ASCE 31 in a report to the building official, and include in said report the assumptions, the methods of analysis, and a description of the analytical results

780 CMR 3409.0 *HISTORIC BUILDINGS*

3409.1 Scope. The provisions of 780 CMR 3409.0 shall govern all buildings and structures in the Commonwealth which are legally designated as *historic buildings*. 780 CMR 3409.0 shall preempt all other regulations of 780 CMR governing the reconstruction alterations change of use and occupancy, repairs maintenance and additions for the conformity of historic buildings and structures to 780 CMR, with the exception of 780 CMR 122.0 for appeals, or unless otherwise specified (*see* 780 CMR 120.Y). There is no obligation for owners of historic properties to apply for 780 CMR 3409.0.

3409.1.1 Key Definitions. The following five definitions are found in 780 CMR 3401.1, but are also presented here as such definitions form a significant portion of 780 CMR 3409.0.

Historic Buildings. (a) Any building or structure individually listed on the National Register of Historic Places or (b) any building or structure evaluated by MHC to be a contributing building within a National Register or State Register District. (c) any building or structure which has been certified by the Massachusetts Historical Commission to meet eligibility requirements for individual listing on the National Register of Historic Places. *Historic building* shall be further defined as *a house museum* or *preserved buildings*. All entries into the *house museum* list shall be certified by the Massachusetts Historical Commission. The Board of Building Regulations and Standards shall ratify all buildings or structures certified by the Massachusetts Historical Commission to qualify for *house museum* listing (see Appendix 780 CMR 120.Y).

Preserved Buildings. (a) Any building or structure individually listed on the National Register of Historic Places or (b) any building or structure certified as a *historic building* by the Massachusetts Historical (Commission/t and not designated a *house museum* in *Appendix 780 CMR 120.Y).*

Restoration. *Restoration* is the process of accurately reconstructing or repairing the forms and details of a building or structure or portion thereof as it appeared at a particular period or periods of time by means of removal of later work/or the replacement of missing original work

House Museum. A *house museum* is an *historic building* or structure. The principal use of such a building or structure must be as an exhibit of the building or the structure itself which is open to the public not less than 12 days per year, although additional uses, original and/ or ancillary to the principal use shall be permitted within the same building up to maximum of 40% of the gross floor area. *House museums* shall be those listed in *Appendix 780 CMR 120.Y*. All entries into the *house museum* list shall be certified by the Massachusetts Historical Commission. The Board of Building Regulations and Standards shall ratify all buildings or structures certified by the Massachusetts Historical Commission to qualify for *house museum* listing (See *Appendix 780 CMR 120.Y*).

3409.2 ***House Museum***.

3409.2.1 State Building Code Exceptions. A *house museum* shall be subject to the following exceptions:

1. Repairs, maintenance and restoration shall be allowed without conformity to 780 CMR generally, if the provisions of 780 CMR 3409.2.2 have been met.
2. In case of fire or other casualty to a *house museum*, said building may be rebuilt, in total or in part, using such techniques and materials as are necessary to restore it to its original condition and use group.
3. If a *historic building* or structure, as a result of proposed work, would become eligible for certification as a *house museum* and the Massachusetts Historical Commission so certifies by affidavit, such affidadit is submitted to the building official with the permit application, and the building official shall then allow the work to proceed under the provisions of 780 CMR 3409.2.

3409.2.2 Mandatory Safety Requirements. All *house museums* shall comply to the following requirements.

3409.2.2.1 Fire Protection Equipment. Fire protection equipment shall be provided according to the following requirements:

1. **Manual Fire Extinguishing Equipment**. All use groups, other than Residential R-3 and R-4, shall have approved manual fire extinguishing equipment, as determined by the head of the local fire department.
2. **Fire Protective Signaling Systems (Fire Alarm Systems)**. All residential buildings in use groups R-1, R-2 and R-3 shall conform to the applicable requirements of 780 CMR 918.0 and 919.0 as applicable. All other use groups shall comply with 780 CMR 3409.2.2.1 items 2.(a) and (b).

(a) **Locations**. Provide smoke detectors in accordance with manufacturers listing and spacing requirements, but not less than one, for every 1200 square feet of floor area per level. In addition, all lobbies, common corridors, hallways and exitway access and discharge routes shall be provided with approved smoke detectors installed in accordance with the manufacturers listing and spacing requirements but not more than 30 feet spacing between detectors. All required smoke detectors shall have an alarm audible throughout the structure or building.

(b) Single station and multiple station smoke detection devices. Smoke detectors of single station and multiple station types shall meet the requirements of UL 217 and be listed or approved by a nationally-recognized fire-testing laboratory. All other smoke detectors shall be listed in accordance with UL 268.

3. **Manual Pull Stations**. A manual fire alarm pull station shall be provided in the natural path of egress in all use groups except R-3 and R-4. Manual pull stations shall be connected to the building fire warning system in conformance with NFPA 72.

3409.2.2.1.1 Supervision. Fire protective signaling systems required by 780 CMR 3409.2.2.1 shall be supervised in accordance with the requirements of 780 CMR 9.00.

Exception. Residential single and multiple station smoke detectors.

3409.2.2.2 Exit Signs and Emergency Lights. Approved exit signs and emergency lighting, where designated by the local building official, shall be provided in compliance with 780 CMR 10.00.

Exception. All *house museums* need not comply with 780 CMR 10.00 if not occupied after daylight hours, except that paths of egress shall have exit signs.

3409.2.2.3 Maximum Occupancy. Occupancy shall be limited by the actual structural floor load capacity as certified by a qualified Massachusetts *registered professional engineer* or *architect* or in accordance with 780 CMR 10.00, whichever is less. Said floor load shall be posted in accordance with the procedures set forth in 780 CMR 120.0, 780 CMR 10.00 and 780 CMR 1617.2. The owner shall submit evidence of this certification and related computations to the building official upon request.

3409.2.2.4 Limited Egress. Where one or more floors of a *house museum* are limited to one *means of egress*, the occupancy load shall be computed as follows:

1. **Floors below the First Story**. Not more than one occupant per 100 square feet of gross floor area with a maximum occupancy of 49.
2. **First Story**. Not more than one occupant per 50 square feet of gross floor area.
3. **Second Story And Above**. Not more than one occupant per 100 square feet of gross floor a area, or 30 occupants per unit of egress width, whichever condition results in the lesser occupancy load.

3409.2.2.5 Inspections. The *building official* and the fire official shall inspect all *house museums* not less frequently than once every year in order to determine that the building or structure continues to conform to 780 CMR 3409.2. A qualified Massachusetts *registered professional engineer* or *architect* shall certify every five years thereafter as to the exact floor load capacity of the building or structure. The building official shall certify all *house museums* not less frequently than once every year. Fees shall be established at $25.00 per building per inspection.

3409.2.2.6 Accessibility for Persons with Disabilities. Accessibility requirements shall be in accordance with 521 CMR.

3409.2.2.7 Energy Conservation. House museums are exempt from the requirements of 780 CMR 3407.0 and the energy conservation requirements of 780 CMR. Muntins, glazing, sills, molding, shutters) shall be permitted without requiring energy code compliance.

3409.2.2.8 Structural Requirements. House museums need not comply with the wind load and seismic load requirements of 780 CMR 3408.0.

3409.3 ***Partially Preserved Buildings***.

3409.3.1 State Building Code Provisions. A *preserved building* shall be subject to the following provisions.

1. **Existing Systems** - individual components of an existing *building system* may be repaired or replaced in kind without requiring that system to comply fully with the code for new construction. (*See* 780 CMR 34.00, 780 CMR 3404.3. *New Systems.)*
2. **Replacement in Kind** - when the repair of historic materials including patching, splicing, piecing-in, consolidating or reinforcing is not possible, compatible materials may be substituted which closely convey the form and design as well as the visual appearance of the existing feature.

3409.3.2 State Building Code Exceptions. A *preserved building* shall be subject to the following exceptions. Repairs or in kind replacement of the following features will be allowed on partially preserved buildings so as not to compromise the architectural integrity of the historical characteristics and qualities which contributed to the eligibility for listing in the National Register of Historic Places.

1. **Roofing** - repair or in kind replacement of an existing historic roof system (i.e., slate, wood, clay, tile, metal) shall be permitted without requiring structural compliance for equivalent new construction providing that dead and live loading requirements have not changed.
2. **Windows** - repair or in kind replacement of existing historic windows (i.e., frames, sash, muntons, glazing, sills, molding, shutters) shall be permitted without requiring energy code compliance.
3. **Entries/Porches** - repair or in kind replacement of existing individual decorative features of an existing system (i.e. columns, balustrades, stairs, pilasters, doors, sidelights) shall be permitted.
4. **Wood Siding/Decorative Elements** - Repair or in kind replacement of an existing system including such items as clapboards, shingles, cornices, brackets, and window and door surrounds shall be permitted.
5. **Masonry** - repair or in kind replacement of masonry units as part of an existing system (i.e., brick, stone, terra cotta, concrete and stucco) shall be permitted.
6. **Metals** - repair or in kind replacement of existing architectural metals (i.e. cast and wrought iron, steel, tin, copper and copper alloys, aluminum, zinc) shall be permitted.
7. **Interior Features** - repair or in kind replacement of non-structural interior features that are important in defining the overall historic character of a building (i.e., columns, cornices, baseboards, fireplace mantels, paneling, window trim, doors, moldings, railings, flooring, plasterwork) shall be permitted.

3409.3.3 Applicability. 780 CMR 3409.3 and 780 CMR 34.00 shall apply to all *preserved buildings*.

3409.3.4 Continuation of Use and Occupancy. The legal use and occupancy of any *preserved building* may be continued without change or further compliance to 780 CMR.

3409.3.5 Inspection Certification and Fees. *preserved buildings* shall not require annual inspection unless otherwise stipulated in 780 CMR 106.5 and Table 106.

3409.3.6 Fire Damage. If a building or structure is damaged from fire or other casualty it may be restored to its original construction or it shall meet the requirements of 780 CMR provided these requirements do not compromise the features for which the building was considered Historic when listed in the National Register of Historic Places.

3409.3.7 Change in Occupancy. See 780 CMR 34.00.

3409.3.8 *New Systems*. See 780 CMR 34.

3409.3.9 Lesser and Equal Hazard. See 780 CMR 34.00. A *preserved building* classified under unprotected construction Type 2C or 5B shall have waived the requirement to add one to the Hazard Index number (See 780 CMR 34.00, Table 3403).

3409.3.10 Greater Hazard. See 780 CMR 34.00. A *preserved building* classified under unprotected construction Type 2C or 5B shall have waived the requirement to add one to the Hazard Index number (See 780 CMR 34.00, Table 3403).

3409.3.11 Energy Conservation. Preserved buildings are exempt from the energy requirements of 780 CMR 13.00 and 61.00.

> **Exception**. Additions to partially preserved buildings shall comply with the energy provisions of 780 CMR 13.00 or of 780 CMR 61.00, as applicable.

3409.3.13 Accessibility for Persons with Disabilities. Accessibility requirements shall be in accordance with 521 CMR.

NON-TEXT PAGE

780 CMR 35.00

REFERENCED STANDARDS

780 CMR 35.00 lists the standards that are referenced in various sections of this document. The standards are listed by the promulgating agency of the standard, the standard identification, the effective date and title, and the section or sections of this document that reference the standard. The application of the referenced standard shall be as specified in 780 CMR 102.4.

AA

Aluminum Association
900 - 19th Street N.W., Suite 300
Washington, DC 20006

Standard reference number	Title	Referenced in code section number
ADM 1 - 00	Aluminum Design Manual: Part 1-A Aluminum Structures, Allowable Stress Design; and Part 1-B - Aluminum Structures, Load and Resistance Factor Design of Buildings and Similar Type Structures	1604.3.5, 2002.1
ASM 35 - 80	Aluminum Sheet Metal Work in Building Construction	2002.1

AAMA

American Architectural Manufacturers Association
1827 Walden Office Square, Suite 104
Schaumburg, IL 60173

Standard reference number	Title	Referenced in code section number
1402 - 86	Standard Specifications for Aluminum Siding, Soffit and Fascia	1404.5.1
101/I.S.2 - 97	Voluntary Specifications for Aluminum, Vinyl (PVC) and Wood Windows and Glass Doors	1627.5.1
101/I.S2/NAFS - 02	Voluntary Performance Specification for Windows, Skylights and Glass Doors	2405.5

AASHTO American Association of State Highway and Transportation Officials

Standard reference number	Title	Referenced in code section number
AASHTO	Standard for H20-44 Truck Loading	1607.6
AASHTO	Standard for HS 20-44 Truck Loading	1607.6
AASHTO	Standard Specifications for Highway Bridges, 17th Edition, 2002	

ACI

American Concrete Institute
P.O. Box 9094
Farmington Hills, MI 48333

Standard reference number	Title	Referenced in code section number
216.1 - 97	Standard Method for Determining Fire Resistance of Concrete and Masonry Construction Assemblies	Table 721.1(2), 721.1
318 - 02	Building Code Requirements for Structural Concrete	Chapters 16.00, 18.00, 19.00 -Numerous
530 - 05	Building Code Requirements for Masonry Structures	1405.5, 1405.5.3, 1405.9 and Chapters 16.00, 21.00 - Numerous
530.1 - 05	Specifications for Masonry Structures	1405.5.1, 1405.9.1, 21.4.1
TG/T1.1 - 01	Acceptance Criteria for Moment Frames Based on Testing	1908.1.3

AF & PA

American Forest and Paper Association
111 19th Street, NW, Suite 800
Washington, DC 20036

Standard reference number	Title	Referenced in code section number
NDS - 05	National Design Specification (NDS) for Wood Construction with 2005 Supplement	721.6.3.2, 2301.2, 2303.5.3, Table 2306.4.1
SDWS-05	AF & PA Supplement. Special Design Provisions for Wind and Seismic	2301.2

AHA

American hard Board Association
1210 West Northwest Highway
Palatine, IL 60067

Standard reference number	Title	Referenced in code section number
A135.4 - 04	Basic Hardboard	1404.3.1
A135.5 - 04	Prefinished Hardboard Paneling	2304.2.2
A135.6 - 98	Hardboard Siding	1404.3.2, 2303.1.6
A194 1 - 85	Cellulosic Fiber Board	2303.6

AISC

American Institute of Steel Construction
One East Wacker Drive, Suite 3100
Chicago, IL 60601-2001

Standard reference number	Title	Referenced in code section number
335 - 89s1	Specification for Structural Steel Buildings—Allowable Stress Design and Plastic Design, including Supplement No.1, 2001	1604.3.3, 2205.1
341 - 02	Seismic Provisions for Structural Steel Buildings	1602.1, 2205.3
HSS (2000)	Load and Resistance Factor Design Specification for Steel Hollow Structural Sections	1604.3.3, 2205.1
LRFD (1999)	Load and Resistance Factor Design Specification for Structural Steel Buildings	1604.3.3, 2205.1

AISI

American Iron and Steel Institute
1140 Connecticut Ave, Suite 705
Washington, DC 20036

Standard reference number	Title	Referenced in code section number
NASPEC	North American Specification for Design of Cold-Formed Steel Structural Members	1604.3.3, 2209.0
General - 2001	Standard for Cold-Formed Steel Framing-General Provisions	2210.1
Header - 2001	Standard for Cold-formed Steel Framing-Header Design	2210.2
Truss - 2001	Standard for Cold-formed Steel Framing-Truss Design	2210.3

AITC

American Institute of Timber Construction
7012 S. Revere parkway Suite 140
Englewood, CO 80112

Standard reference number	Title	Referenced in code section number
A 190.1 - 92	Structural Glued Laminated Timber	2303.4
Technical Note 7-96	Calculation of Fire Resistance of Glued Laminated Timbers	721.6.3.3

ANSI

American National Standards Institute
25 West 23rd Street, Fourth Floor
New York, NY 10036

Standard reference number	Title	Referenced in code section number
A 13.1 - 96	Scheme for the Identification of Piping Systems	415.9.6.4
A118.4 - 99	Specifications for Latex-portland Cement Mortar	2103.9.3
A118.5 - 99	Specifications for Chemical Resistant Furan Mortar and Grouts for Tile Installation	2103.9.5
A118.6 - 99	Specifications for Cement Grouts for Tile Installation	2103.9.8
Z 97.1 - 84 (R1994)	Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test (Reaffirmed 1994)	2406.1.3, 2406.1.2, 2407.1

ASCE/SEI

American Society of Civil Engineers, Structural Engineering Institute
1801 Alexander Bell Drive
Reston, VA 20191-4400

Standard reference number	Title	Referenced in code section number
3-91	Standard Practice for the Construction and Inspection of Composite Slabs	1604.3.3, 2209.2
5-02	Building Code Requirements for Masonry Structures	1405.5, 1405.5.3, 1405.9, 1604.3.4, 1704.5, 1704.5.1, Table 1704.5.1, 1704.5.2, Table 1708.1.1, 1708.1.2, 1708.1.3, 1805.5.2, 1812.7, 2101.2.5, 2103.11.6, 2106.1, 2106.1.1.1, 2106.1..1.2, 2106.1.1.3, 2106.3, 2106.4, 2106.5, 2106.6, 2107.1, 2107.2, 2107.2.1, 2107.2.2, 2107.2.4, 2107.2.5, 2107.2.6, 2108.1, 2108.2, 2108.4, 2109.1, 2109.2.3.1, 2109.2.3.2
6-02	Specifications for Masonry Structures	1405.5.1, 1405.9.1, Table 1704.5.3, 1805.5.2, 2103.11.7, 2104.1.1, 2104.3
7-02	Minimum Design Loads for Buildings and Other Structures	1605.1, 1608.1, 1608.3
8-02	Standard Specification for the Design of Cold-formed Stainless Steel Structural Members	1604.3.3, 2209.1
16-95	Standard for Load Resistance Factor Design (LRFD) for Engineered Wood Construction	Chapter 23.00
19-96	Structural Applications of Steel Cables for Buildings	2207.1. 2207.2
24-05	Flood Resistant Design and Construction	1203.3.2, 3001.2, Chapter 16.00
29-99	Standard Calculation Methods for Structural Fire Protection	721.1
31-03	Seismic Evaluation of Buildings	3408.0
32-01	Design and Construction of Frost Protected Shallow Foundations	1805.2.1
37-02	Design Loads on Structures During Construction	Chapter 33.00

ASME

American Society of Mechanical Engineers
Three Park Avenue
New York, NY 10016-5990

Standard reference number	Title	Referenced in code section number
A17.1 - 2004	Safety Code for Elevators and Escalators	1007.4
B31.3-99	Process Piping - Including Addendum	415.9.6.1

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Standard reference number	Title	Referenced in 780 CMR Section number
A 6/A 6M- 01b	Specification for General Requirements for Rolled Steel, Structural Steel Bars, Plates, Shapes, and Sheet Piling	
A 36/A 36M-08	Specification for Carbon Structural Steel	1809.3.1
A 242-08	Specification for High-strength Low-alloy Structural Steel	
A252-e 01	Specification for Welded and Seamless Steel Pipe Piles	1809.3.1, 1810.6.1
A283/A 283M - 07	Specification for Low and Intermediate Tensile Strength Carbon Steel Plates	1809.3.1, 1810.6.1
A416-06	Specification for Steel Strand, Uncoated Seven Wire for Prestressed Concrete	1809.2.3.1
A435/A 435M - 90 (2001)	Specification for Straight-beam Ultrasonic Examination of Steel Plates	1708.4
A 529-05	Specification for High Strength Carbon-manganese Steel or Structural Qualitty	
A 572/A 572M -07	Specification for High-strength Low-alloy Columbium - Vanadium Steels of Structural Quality	1809.3.1
A 588/A 588M-05	Specification for High-strength Low-alloy Structural Steel with 50 ksi (345 Mpa) Minimum Yield Point to four inches (100 mm) Thick	1809.3.1
A 615/A 615M -00	Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement	1708.3, 1908.1.8
A 653/A 653M- 01a	Specification for Steel Sheet, Zinc-coated Galvanized or Zinc-iron Alloy-coated Galvanized by the Hot-dip Process	2211.2, 2211.2.2.1
A 755/A 755M-01	Specification for Steel Sheet, Metallic - Coated by the Hot - Dip Process and Prepainted by the Coil - Coating Process for Exterior Exposed Building Products	Table 1507.4.3
A 792/A 792M-01a	Specification for Steel Sheet, 55% Aluminum-zinc Alloy-coated by the Hot-dip Process	Table 1507.4.3, 2211.2.2, 2211.2.2.1
A 875M-99a	Specification for Steel Sheet Zinc-54% Aluminum Alloy-Coated by the Hot-dip Process	2211.2.2, 2211.2.2.1
A 898/A 898M - 91 (2001)	Specification for Straight Beam Ultrasonic Examination of Rolled Steel Shapes	1708.4
A 913/A 913M - 07	Specification for High-strength Low-alloy Steel Shapes of Structural Quality, Produced by Quenching and Self-tempering Process (QST)	1809.3.1
A 992-06	Specification for Structural Steel Shapes	
B42-98	Specification for Seamless Copper Pipe, Standard Sizes	909.13.1
B43-98	Specification for Seamless Res Brass Pipe, Standard Sizes	909.13.1
B68M-99	Specification for Seamless Copper Tube, Bright Annealed (Metric)	909.13.1
B88-99e	Specification for Seamless Copper Water Tube	909.13.1
B101-01	Specification for Lead-coated Copper Sheet and Strip for Building Construction	Table507.4.3
B 209-96	Specification for Aluminum and Aluminum-Alloy Sheet and Plate	3609.5.2
B251-97	Specification for General Requirements for Wrought Seamless Copper and Copper-alloy Tube	909.13.1
B280-99el	Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service	909.13.1
B633-98	Specification for Electrodeposited Coatings of Zinc on Iron and Steel	2211.2
C5 -97	Specification for Quicklime for Structural Purposes	Table 2505.2, 3607.2 2
C22/C 22M-00	Specification for Gypsum	Table 2506.2
C27-98	Specification for Standard Classification of Fireclay and High-alumina Refractory Brick	2111.5, 2111.8
C28.C 28M-00	Specifications for Gypsum Plasters	Table 2505.2, 3607.2.2
C 31/31M-9-8	Practice for Making and Curing Concrete Test Specimens in the Field	Table 1704.4
C 33-01a	Specifications for Concrete Aggregates	721.3.1.4, 721.4.1.1.3
C 35-95(2001)	Specifications for Inorganic Aggregates for Use in Gypsum Plaster	Table 2505.2, 3607.2.2
C 36/C-36M-01	Specifications for Gypsum Wallboard	Figure 721.5.1(2), Figure 721.5.1(3), Table 721.5.1(2), Table 2506.2
C 37/C 37M-01	Specifications for Gypsum Lath	Table 2507.2
C 55-01A	Specification for Concrete Brick	Table 721.3.2
C 59/C 59M-00-91	Specifications for Gypsum Casting and Molding Plaster	Table 2507.2
C 61/C 61M-00	Specifications for Gypsum Keene's Cement	Table 2507.2
C 62-01	Specifications for Building Brick (Solid Masonry Units made from Clay or Shale)	2105.2.2.1.1

ASTM

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Standard reference number	Title	Referenced in 780 CMR Section number
C 67-02	Test Methods of Sampling and Testing Brick and Structural Clay Tile	721.4 1.1.1, 1507.3.5
C 73-99a	Specifications for Calcium Silicate Face Brick (Sand Lime Brick)	Table 721.3.2,
C 79-01	Specification for Treated Core and Non-treated Core Gypsum Sheathing Board	Table 2506.2
C 90-06	Specification for Loadbearing Concrete Masonry Units	Table 721.3.2
C91 - 01	Specification for Masonry Cement Table	Table 2507.2
C 94/C 94M - 00	Specification for Ready-Mixed Concrete	109.3.1
C 140 - 01 ae1	Test Method Sampling and Testing Concrete Masonry Units and Related Units	721.3.1.2, 1507.3.5
C150 - 99a	Specification for Portland Cement	1904.1
C 150 - 01	Specification for Portland Cement	Table 2507.2
C 172 - 99	Practice for Sampling Freshly Mixed Concrete	Table 1704.4
C 206 - 84 (1997)	Specification for Finishing Hydrated Lime	Table 2507.2
C 208 - 95	Specification for Cellulosic Fiber Insulating Board	2303.1.5
C 317/C 317M - 00	Specification for Gypsum Concrete	1915.1
C 330 - 99	Specification for Lightweight Aggregates for Structural Concrete	721.1.1
C 331 - 01	Specification for Lightweight Aggregates for Concrete Masonry Units	721.3.1.4, 721.4.1.1.3
C 442/C 442M - 01	Specification for Gypsum Backing Board and Coreboard and Gypsum Shaftliner Board	Table 2506.2
C472 - 99	Specification for Standard Test Methods for Physical Testing of Gypsum, Gypsum Plasters and Gypsum Concrete	Table 2506.2
C 473 - 00	Test Method for Physical Testing of Gypsum Panel Products	Table 2506.2
C 474 - 01	Test Methods for Joint Treatment Materials for Gypsum Board Construction	Table 2506.2
C 475 - 01	Specification for Joint Compound and Joint Tape for Finishing Gypsum Wallboard	Table 2506.2
C 514 - 01	Specification for Nails for the Application of Gypsum Board	Table 721.1(2), Table 721.1(3), Table 2306.4.5, Table 2506.2
C516 - E01	Specifications for Vermiculite Loose Fill Thermal Insulation	721.3.1.4, 721.4 1.1.3
C547 - 00	Specification for Mineral Fiber Pipe Insulation	Table 721.1(2), Table 721.1(3)
C549 - 81 (1995)	Specification for Perlite Loose Fill Insulation	721.3.1.4, 721.4.1.1.3
C557 - 99	Specification for Adhesives for Fastening Gypsum Wallboard to Wood Framing	Table 2506.2
C 587 - 97	Specification for Gypsum Veneer Plaster	Table 2507.2
C 588/C 588M - 01	Specification for Gypsum Base for Veneer Plasters	Table 2507.2
C 595 - 01	Specification for Blended Hydraulic Cements	Table 2507.2
C 630/C 630M - 01	Specification for Water-resistant Gypsum Backing Board	Table 2506.2
C 631 - 00	Specification for Bonding Compounds for Interior Gypsum Plastering	Table 2507.2
C 635 - 00	Specification for the Manufacturer, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings	803.9.1.1, 2506.2.1
C 636 - 96	Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels	803.9.1.1
C 645 - 00	Specification for Nonstructural Steel Framing Members	Table 2506.2, Table 2507.2
C 754 - 00	Specification for Installation of Steel Framing Members to Receive Screw-attached Gypsum Panel Products	Table 2508.1, Table 2511.1
C 836 - 00	Specification for High-solids Content, Cold Liquid-applied Elastomeric Waterproofing Membrane for Use with Separate Wearing Course	1507.15.2
C 840 - 01	Specification for Application and Finishing of Gypsum Board	Table 2508.1, 2509.2
C 841 - 99	Specification for Installation of Interior Lathing and Furring	Table 2508.1, Table 2511.1
C 842 - 99	Specification for Application of Interior Gypsum Plaster	Table 2511.1, 2511.3, 2511.4
C 843 - 99	Specification for Application of Gypsum Veneer Plaster	Table 2511.1
C 844 - 99	Specification for Application of Gypsum Base to Receive Gypsum Veneer Plaster	Table 2508.1
C 845 - 96	Specification for Expansive Hydraulic Cement	1904.1
C 847 - 00	Specification for Metal Lath	Table 2507.2

ASTM

ASTM International
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Standard reference number	Title	Referenced in 780 CMR Section number
C 887-05	Specification for Packaged, Dry Combined Materials for Surface Bonding Mortar	1807.2.2
C 897 - 00	Specification for Aggregate for Job-Mixed Portland Cement-Based Plasters	Table 2507.2
C 926 - 98a	Specification for Application of Portland Cement Based-Plaster	2510.3, Table 2511.1, 2511.3, 2511.4, 2512.1, 2512.1.2 2512.2, 2512.6, 2512.8.2, 2513.7, 2512.9
C 931/C 931M - 01	Specification for Exterior Gypsum Soffit Board	Table 2506.2
C 932 - 98a	Specification for Surface-applied Bonding Agents for Exterior Plastering	Table 2507.2
C 933 - A(2001)	Specification for Welded Wire Lath	Table 2507.2
C 954 - 00	Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs from 0.033 inch (0.84 mm) to0.112 inch (2.84 mm) in Thickness	2211.2.2.2, Table 2506.2, Table 2507.2
C 955 - 01	Specification for Load Bearing Transverse and Axial Steel Studs, Runners Tracks ,and Bracing or Bridging, for Screw Application of Gypsum Panel Products and Metal Plaster Bases	Table 2506.2, Table 2507.2
C 956 - 97	Specification for Installation of Cast-in-place Reinforced Gypsum Concrete	1915.1
C 957 - 98	Specification for High-solids Content, Cold Liquid-applied Elastomeric Waterproofing Membrane with Integral Wearing Surface	1507.15.2
C 960 - 97	Specification for Predecorated Gypsum Board	Table 2506.2
C1002 - 01	Specification for Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs	Table 2506.2, Table 2507.2
C1007 - 00	Specification for Installation of Load Bearing (Transverse and Axial) Steel Studs and Related Accessories	Table 2508.1, Table 2511.1
C1029 - 96	Specification for Spray-applied Rigid Cellular Polyurethane Thermal Insulation	1507.14.2
C1032 - 96	Specification for Woven Wire Plaster Base	Table 2507.2
C1047 - 99	Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base	Table 2506.2, Table 2507.2
C1063 - 99	Specification for Installation of Lathing and Furring to Receive Interior and Exterior Portland Cement Based Plaster	2510.3, Table 2511.1, 2512.1.1
C1167 - 96	Specification for Clay Roof Tiles	1507.3.4, 1507.3.5
C1177/C1177M - 01	Specification for Glass Mat Gypsum Substrate for Use as Sheathing	Table 2506.2
C1178/C1178M - 01	Specification for Glass Mat Water-resistant Gypsum Backing Panel	Table 2506.2
C1186 - 99	Specification for Flat Nonasbestos Fiber Cement Sheets	1404.10
C1278/C 1278M - 01	Specification for Fiber-reinforced Gypsum Panels	Table 2506.2
C1280 - 99	Specification for Application of Gypsum Sheathing	Table 2508.1, 2508.1, Table 2508.2, 2508.2
C1328 - 00	Specification for Plastic (Stucco Cement)	Table 2507.2
C1395/1395M - 01	Specification for Gypsum Ceiling Board	Table 2506.2
D25-05	Specification for Round Timber Piles	1809.1.1
D 41 - E01	Specification for Asphalt Primer Used in Roofing, Dampproofing and Waterproofing	Table1507.10.2
D 43 - 00	Coal Tar Primer Used in Roofing, Dampproofing and Waterproofing	Table 1507.10.2
D 56 - 01	Test Method for Flash Point By Tag Closed Tester	307.2
D 86 - 01e01	Test Method for Distillation of Petroleum Products	307.2
D 93 - 00	Test Method for Flash Point By Pensky-Martens Closed Cup Tester	307.2
D 224 - 89 (1996)	Specification for Smooth-Surfaced Asphalt Roll Roofing (Organic Felt)	1507.2.9.2, 1507.6.4
D 225 - 01	Specification for Asphalt Shingles (Organic Felt) Surfaced with Mineral Granules	1507.2.5
D 226 - 97a	Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing	1404.2, Table 1507.2, 1507.2.3, 1507.3.3, 1507.5.3, 1507.6.3, 1507.7.3, Table 1507.8, 1507.8.3, 1507.9.3, 1507.9.4, Table 1507.10.2
D227 - 97a	Specification for Coal-tar-saturated Organic Felt Used in Roofing and Waterproofing	Table 1507.10.2

ASTM

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Standard reference number	Title	Referenced in 780 CMR Section number
D 249 - 89 (1996)	Specification for Asphalt Roll Roofing (Organic Felt) Surfaced with Mineral Granules	1507.3.3, 1507.6.4
D 312 - 00	Specification for Asphalt Used in Roofing	Table 1507.10.2
D 371 - 89 (1996)	Specification for Asphalt Roll Roofing (Organic Felt) Surfaced with Mineral Granules: Wide-selvage	1507.6.4
D 422 - 98	Test Method for Particle-size Analysis of Soils	1802.3.2
D 450 - 00	Specification for Coal-tar Pitch Used in Roofing, Dampproofing and Waterproofing	Table 1507.10.2
D 635 - 98	Test Method for Rate of Burning and/or Extent and Time of Burning of Self-Supporting Plastics in a Horizontal Position	2606.4
D1143 - 07	Test Method for Piles Under Static Axial Compressive Load	1808.2.8.3
D1227 - 00	Specification for Emulsified Asphalt Used as a Protective Coating for Roofing	Table 1507.10.2, 1507.15.2
D1557 - 00	Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lb/ft^3 (2,700 KN m/m^3))	1803.5
D1586 - 99	Specification for Penetration Test and Split-barrel Sampling of Soils	1615.1.5
D1863 - 93 (2000)	Specification for Mineral Aggregate Used on Built-up Roofs	Table 1507.10.2
D1929 - 96 (2001)E01	Test Method for Determining Ignition Properties of Plastics	402.14.4, 406.5.2, 1407.11.2.1, 2606.4
D1970 - 01	Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roof Underlayment for Ice Dam Protection	1507.2.4, 1507.2.9.2
D2166 - 00	Test Method for Unconfined Compressive Strength of Cohesive Soil	1615.1.5
D2178 - 97a	Specification for Asphalt Glass Felt Used in Roofing and Waterproofing	Table 1507.10.2
D2216 - 98	Test Method for Laboratory Determination of Water(Moisture) Content of Soil and Rock by Mass	1615.1.5
D2487 - 00	Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System)	Table 1610.1, 1802.3.1
D2626 - 97b	Specification for Asphalt Saturated and Coated Organic Felt Base Sheet Used in Roofing	1507.3.3, Table 1507.10.2
D2822 - 91(97) el	Specification for Asphalt Roof Cement	Table 1507.10.2
D2823 - 90(97) el	Specification for Asphalt Roof Coatings	Table 1507.10.2
D2843 - 99	Test for Density of Smoke from the Burning or Decomposition of Plastics	2606.4
D2850 - 95(1999)	Test Method for Unconsolidated, Undrained Triaxial Compression Test on Cohesive Soils	1615.1.5
D2898 - 94 (1999)	Test Methods for Accelerated Weathering of Fire-Retardant-Treated Wood for Fire Testing	1505.1, 2303.2.1, 2303.2.3
D3019 - e01(Supp)	Specification for Lap Cement Used with Asphalt Roll Roofing, Nonfibered, Asbestos Fibered, and Nonasbestos Fibered	Table 1507.10.2
D3161 - 99a	Test Method for a Wind Resistance of Asphalt Shingles (Fan Induced Method)	1507.2.7
D3201 - 94 (1998) el	Test Method for Hygroscopic Properties of Fire-Retardant Treated Wood and Wood-base Products	2303.2.4
D3278 - 96e01	Test Methods for Flash Point of Liquids by Small Scale Closed-Cup Apparatus	307.2
D3462 - E01	Specification for Asphalt Shingles Made from Glass Felt and Surfaced with Mineral Granules	1507.2.5
D3468 - 99	Specification for Liquid-applied Neoprene and Chlorosulfonated Polyethylene Used in Roofing and Waterproofing	1507.15.2
D3679 - 01c	Specification for Rigid Poly [Vinyl Chloride (PVC) Siding]	1404.9, 1405.13
D3689-07	Method for Testing Individual Piles Under Static Axial Tensile Load	1808.2.8.5
D3737 - 01B	Practice for Establishing Allowable Properties for Structural Glued Laminated Timber (Glulam)	2303.1.3
D3746 - 85 (1996) el	Test Method for Impact Resistance of Bituminous Roofing Systems	1504.7
D3747 - E01	Specification for Emulsified Asphalt Adhesive for Adhering Roof Insulation	Table 1507.10.2
D3909 - 97b	Specification for Asphalt Roll Roofing (Glass Felt) Surfaced with Mineral Granules	1507.6.4, Table 1507.10.2
D3966-07	Test Methods for Deep Foundations Under Lateral Load	

ASTM

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Standard reference number	Title	Referenced in 780 CMR Section number
D4022 - 00	Specification for Coal Tar Roof Cement, Asbestos Containing	Table 1507.10.2
D4272 - 99	Test Method for Total Energy Impact of Plastic Films by Dart Drop	1504.7
D4318 - 00	Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils	1615.1.5, 1802.3.2
D4434 - 96	Specification for Poly (Vinyl Chloride) Sheet Roofing	1507.13.2
D4479 - 00	Specification for Asphalt Roof Coatings - Asbestos-Free	Table 1507.10.2
D4586 - 00	Specification for Asphalt Roof Cement, Asbestos-Free	Table 1507.10.2
D4601 - 98	Specification for Asphalt-Coated Glass Fiber Base Sheet Used in Roofing	Table 1507.10.2
D4637 - 96	Specification for EPDM Sheet Used in Single-ply Roof Membrane	1507.12.2
D4829 - 95	Test Method for Expansion Index of Soils	1802.3.2
D4869 - 93	Specification for Asphalt-Saturated (Organic Felt) Underlayment Used in Steep Slope Roofing	Table1507.2, 1507.2.3
D4897 - 01	Specification for Asphalt-Coated Glass Fiber Venting Base Sheet Used in Roofing	Table 1507.10.2
D4990 - 97a	Specification for Coal Tar Glass Felt Used in Roofing and Waterproofing	Table 1507.10.2
D4945 - 00	Test Method for High-Strain Dynamic Testing of Piles	1808.2.8.3
D5019 - 96	Specification for Reinforced Nonvulcanized Polymeric Sheet Used in Roofing Membrane	1507.12.2
D5055 - 00	Specification for Establishing and Monitoring Structural Capacities of Prefabricated Wood I-joists	2303.1.2
D5456 - 01AE01	Specification for Evaluation of Structural Composite Lumber Products	2303.1.9
D5516 - 99a	Test Method of Evaluating the Flexural Properties of Fire-Retardant Treated Softwood Plywood Exposed to the Elevated Temperatures	2303.2.2.1
D5643 - 00	Specification for Coal Tar Roof Cement, Asbestos-free	Table 1507.10.2
D5664 - 01	Test Methods for Evaluating the Effects of Fire-Retardant Treatment and Elevated Temperatures on Strength Properties of Fire-Retardant Treated Lumber	2303.2.2.2
D5665 - 99a	Specification for Thermoplastic Fabrics Used in Cold-Applied Roofing and Waterproofing	Table 1507.10.2
D5726 - 98	Specification for Thermoplastic Fabrics Used in Hot-Applied Roofing and Waterproofing	Table 1507.10.2
D6083 - 97a	Specification for Liquid Applied Acrylic Coating Used in Roofing	Table 1507.10.2, 1507.15.2
D6162 - 00A	Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using a Combination of Polyester and Glass Fiber Reinforcements	1507.11.2
D6163 - 00 E01	Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using Glass Fiber Reinforcements	1507.11.2
D6164 - 00	Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Metal Materials Using Polyester Reinforcements	1507.11.2
D6222 - 98	Specification for Atactic Polypropylene (APP) Modified Bituminous Sheet Materials Using Polyester Reinforcements	1507.11.2
D6223 - 98	Specification for Atactic Polypropylene (APP) Modified Bituminous Sheet Materials Using a Combination of Polyester and Glass Fiber Reinforcements	1507.11.2
D6298 - 98	Specification for Fiberglass Reinforced Styrene-Butadiene-Styrene (SBS) Modified Bituminous Sheets with a Factory Applied Metal Surface	1507.11.2
D6305 - 99e1	Practice for Calculating Bending Strength Design Adjustment Factors for Fire-retardant-treated Plywood Roof Sheathing	2303.2.2.1
E 84 - 01	Test Methods for Surface Burning Characteristics of Building Materials	402.10, 402.14.4, 406.5.2, 410.3.5.3, 703.4.2, 719.1, 719.4, 802.1, 803.1, 803.5, 803.6.1, 803.6.2,1407.10, 1407.10.1, 2303.2, 2603.3, 2603.4.1.13, 2603.5.4, 2604.2.4, 2606.4, 3105.3
E 90 - 99	Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements	1207.2
E 96 - 00	Test Method for Water Vapor Transmission of Materials	1203.2

ASTM

ASTM International
100 Barr Harbor Dr.
West Conshohocken, PA 19428-2959

Standard reference number	Title	Referenced in 780 CMR Section number
E 108 - 00	Test Methods for Fire Tests of Roof Coverings	1505.1, 2603.6, 2610.2, 2610.3
E 119 - 00a	Test Methods for Fire Tests of Building Construction and Materials	410.3.5.2, 703.2, 703.2.1, 703.2.3, 703.3, 704.7, 704.9, 706.7, 711.3.2, 712.3.1, 712.4.1, 712.4.6, 713.1, 713.4, 714.7, 715.2,716.5.2, 715.5.3.1, 715.6.2, 716.5.2, 716.5.3.1, 716.6.2, Table 721.1(1), 1407.10.2, 2603.3, 2603.4, 2603.4.1.13, 2603.5.4, 2604.2.4, 2606.4
E136 - 99	Test Method for Behavior of Materials in a Vertical Tube Furnace at 750°C	703.4.1
E 330 - 97	Test Method for Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference	1714.5.2
E 331 - 00	Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference	1403.2
E 492 - 90 (1996)e1	Test Method for Laboratory Measurement of Impact Sound Transmission Through Floor-ceiling Assemblies Using the Tapping Machine	1207.3
E 605 - 00	Test Method for Thickness and Density of Sprayed Fire-resistive Material (SFRM)Applied to Structural Members	1704.11.3, 1704.11.3.1, 1704.11.3.2, 1704.11.4
E 681 - 01	Test Methods for Concentration Limits of Flammability of Chemical Vapors and Gases	307.2
E 736 - 00	Test Method for Cohesion/Adhesion of Sprayed Fire-resistive Materials Applied to Structural Members	1704.11.5
E 814 - 00	Test Method of Fire Tests of Through-penetration Firestops	702.1, 712.3.1.2, 712.4.1.2
E 970 - 00	Test Method for Critical Radiant Flux of Exposed Attic Floor Insulation Using a Radiant Heat Energy Source	719.3.1
E1300 - 00	Practice for Determining Load Resistance of Glass in Buildings	Table 2404.1, Table 2404.2
E1592 - 01	Test Method for Structural Performance of Sheet Metal Roof and Siding Systems by Uniform Static Air Pressure Difference	1504.3.2
E1602 - 01	Guide for Construction of Solid Fuel-Burning Masonry Heaters	2112.2
E1886 - 97	Test Method for Performance of Exterior Windows, Curtain Wall, Doors and Storm Shutters Impacted by Missiles and exposed to Cyclic Pressure Differentials	1609.1.4
E1966 - 00	Test Method for Fire-Resistant Joint Systems	702.1, 712.3
E1996 - 01	Specification for Performance of Exterior Windows, Glazed Curtain Walls, Doors and Storm Shutters Impacted by Windborne Debris in Hurricanes	1609.1.4
F 547 - 01	Terminology of Nails for Use with Wood and Wood-base Materials	Table 2506.2
F1346 - 91 (1996)	Performance Specification for Safety Covers and Labeling Requirements for All Covers for Swimming Pools, Spas and Hot Tubs	Appendix 120.M
F1667 - 01A	Specification for Driven Fasteners: Nails, Spikes, and Staples	Table 721.1(2), Table 721.1(3), 1507.2.6, 2303.6, Table 2506.2
G 152 - 00A	Practice for Operating Open Flame Carbon Arc Light Apparatus for Exposure of Nonmetallic Materials	1504.5
G 154 - 00A	Practice for Operating Fluorescent Light Apparatus for UV Exposure of Nonmetallic Materials	1504.5
G 155 - 00A	Practice for Operating Xenon Arc Light Apparatus for Exposure of Non-Metallic Materials	1504.5

AWPA

American Wood-Preservers' Association
P.O. Box 5690
Granbury, Texas 76049

Standard reference number	Title	Referenced in code section number
C1 - 00	All Timber Products - Preservative Treatment by Pressure Processes	1403.6, 1505.6
C2 - 01	Lumber, Timbers, Bridge Ties and Mine Ties - Preservative Treatment by Pressure Processes	1403.6, Table 1507.9.5, 1805.4.5, 1805.7.1, 2303.1.8, 2304.11.2, 2304.11.4
C3 - 99	Piles - Preservative Treatment by Pressure Processes	1403.6, 1805.4.5, 1809.1.2
C4 - 99	Poles - Preservative Treatment by Pressure Processes	1403.6, 1805.7.1, 1808.1.2
C9 - 00	Plywood - Preservative Treatment by Pressure Processes	1403.6, 2303.1.8 2304.11.4, 2304.11.7
C15 - 00	Wood for Commercial-Residential Construction Preservative Treatment by Pressure Process	1403.6
C18 - 99	Standard for Pressure Treated Material in Marine Construction	1403.6
C22 - 96	Lumber and Plywood for Permanent Wood Foundations - Preservative Treatment by Pressure Processes	1403.6
C23 - 00	Round Poles and Posts Used in Building Construction - Preservative Treatment by Pressure Processes	1403.6
C24 - 96	Sawn Timber Used to Support Residential and Commercial Structures	1403.6, 1809.1.2
C28 - 99	Standard for Preservative Treatment by Pressure Process of Structural Glued Laminated Members and Laminations Before Gluing	1403.6
C31 - 01	Lumber Used Out of Contact With the Ground and Continuously Protected from Liquid Water - Treatment by Pressure Processes	
C33 - 00	Standard for Preservative Treatment of Structural Composite Lumber by Pressure Processes	
M4 - 01	Standard for the Care of Preservative-treated Wood Products	1809.1.2
P1/P13 - 01	Standard for Creosote Preservative	1403.6
P2 - 01	Standard for Creosote Solutions	1403.6
P3 - -01	Standard for Creosote-petroleum Solutions	1403.6

BHMA

Builders Hardware Manufacturers' Association'
355 Lexington Avenue, 14th Floor
New York, New York 10017-6603

Standard reference number	Title	Referenced in code section number
A156.10-99A	American National Standard for Power Operated Pedestrian Doors	1008.1.3.2
A156-97	American National Standard for Power Assist and Low Energy Operated Doors	1008.1.3.2

CGSB

Canadian General Standards Board
Place du Portage 111, 6B1
11 Laurier Street
Gatineau, Quebec, Canada KIA IG6

Standard reference number	Title	Referenced in code section number
37-GP - 52M - (1984)	Roofing and Waterproofing Membrane, Sheet Applied, Elastomeric	1504.7, 1507.12.2
37-GP - 56M - (1980)	Membrane, Modified Bituminous, Prefabricated and Reinforced for Roofing - with December 1985 Amendment	1507.11.2
CAN/CGSB-37.54-95	Polyvinyl Chloride Roofing and Waterproofing Membrane	1507.13.2

CMR

Code of Massachusetts Regulations
Secretary of the Commonwealth
Regulations Division
One Ashburton Place, Boston, MA 02108

Various construction code requirements and other regulatory requirements are found in CMRs in addition to the regulatory requirements of the Massachusetts State Building Code (780 CMR); the CMRs identified below, along with the State Agency or Board that promulgates same, are referenced in the Seventh Edition of the Massachusetts State Building Code.

Standard reference number	Title	Referenced in code section number
105 CMR	Department of Public Health	When applicable
248 CMR	Board of State Examiners of Plumbers and Gasfitters	When applicable
310 CMR	Department of Environmental Protection	When applicable
314 CMR	Division of Water Pollution Control	When applicable
520 CMR	Department of Public Safety	When applicable
521 CMR	Architectural Access Board	When applicable
522 CMR	Board of Boiler Rules	When applicable
524 CMR	Board of Elevator Regulations	When applicable
526 CMR	Recreational Tramway Board	When applicable
527 CMR	Board of Fire Prevention Regulations	When applicable
528 CMR	Bureau of Pipefitters & Refrigeration Technicians	When applicable

CPSC

Consumer Product Safety Commission
4330 East West Highway
Bethesda, MD 20814-4408

Standard reference number	Title	Referenced in code section number
16 CFR Part 1201 (1977)	Safety Standard for Architectural Glazing	2406.1.1, 2406.2.1, 2407.1, 2408.2.1, 2408.3
16 CFR Part 1209 (1979)	Interim Safety Standard for Cellulose Insulation	719.6
16 CFR Part 1404 (1979)	Cellulose Insulation	719.6
16 CFR Part 1500 (1991)	Hazardous Substances and Articles; Administration and Enforcement Regulations	307.2
16 CFR Part 1500.44 (2001)	Method for Determining Extremely Flammable and Flammable Solids	307.2
16 CFR Part 1507 (2001)	Fireworks Devices	307.2
16 CFR Part 1630 (2000)	Standard for the Surface Flammability of Carpets and Rugs	804.5.1

CSSB

Cedar Shake & Shingle Bureau
P.O. Box 1178
Sumas, WA 98295-1178

Standard reference number	Title	Referenced in code section number
CSSB - 97	Grading and Packing Rules for Western Red Cedar Shakes and Western Red Shingles of the Cedar Shake and Shingle Bureau	Table 1507.8.4, Table 1507.9.5

DASMA

Door and Access Systems Manufacturers Association International
1300 Summer Avenue
Cleveland, OH 44115-2851

Standard reference number	Title	Referenced in code section number
107 - 97	Room Fire Test Standard for Garage Doors Using Foam Plastic Insulation	2603.4.1.9

DOC

United States Department of Commerce
100 Bureau Drive Stop 3460
Gaithersburg, MD 20899

Standard reference number	Title	Referenced in code section number
PS 1 - 95	Construction and Industrial Plywood	2211.2.2.2, 2303.1.4
PS 2 - 92	Performance Standard for Wood-based Structural-use Panels	1809.1.1, 2211.3.1
PS 20 - 99	American Softwood Lumber Standard	1809.1.1, 2302.1

DOL

U.S. Department of Labor
c/o Superintendent of Documents
U.S. Government Printing Office
Washington, DC 20402-9325

Standard reference number	Title	Referenced in code section number
29 CFR Part 1910.1000 (1974)	Air Contaminants	902.1

DOTn

U.S. Department of Transportation
c/o Superintendent of Documents
U.S. Government Printing Office
Washington, DC 20402-9325

Standard reference number	Title	Referenced in code section number
49 CFR (1998)	Specification of Transportation of Explosive and Other Dangerous Articles, UN 0335,UN 0336 Shipping Containers	307.2
49 CFR Parts 173.137 (1990)	Shippers - General Requirementsfor Shipments and Packaging - Class 8 - Assignment of Packaging Group	307.2

FEMA

Federal Emergency Management Agency
Federal Center Plaza
500 C Street, SW
Washington, DC 20472

Standard reference number	Title	Referenced in code section number
Pub 302 (1997)	NEHRP Recommended Provisions for Seismic Regulations for New Buildings and Other Structures	

FM

Factory Manual
Standards Laboratories Department
1151 Boston Providence Turnpike
Norwood, MA 02062

Standard reference number	Title	Referenced in code section number
4450 - (1989)	Approval Standard for Class 1 Insulated Steel Deck Roofs - with Supplements through July 1992	1504.3.1, 1508.1, 2603.3, 2603.4.1.5
4470 (1992)	Approval Standard for Class 1 Roof Covers	1504.3.1, 1504.7
4880 - (2001)	American National Standard for Evaluating Insulated Wall or Wall and Roof/Ceiling Assemblies, Plastic Interior Finish Materials, Plastic Exterior Building Panels, Wall/Ceiling Coating Systems, Interior or Exterior Finish Systems	2603.4, 2603.8

GA

Gypsum Association
810 First Street, Northeast, Suite 510
Washington, DC 20002-4268

Standard reference number	Title	Referenced in code section number
GA 216 - 00	Application and Finishing of Gypsum Board	Table 2508.1, 2509.2
GA 600 - 00	Fire-resistance Design Manual,16th Edition, April, 2000	Table 721.1(1), Table 721.1(2), Table 721.1(3)

HPVA

Hardwood Plywood & Veneer Association
1825 Michael Faraday Drive
Reston, VA 20190-5350

Standard reference number	Title	Referenced in code section number
HP-1 - 2000	The American National Standard for Hardwood and Decorative Plywood	2303.11, 2304.2.2

ICC

International Code Council
5203 Leesburg Pike, Suiter 600
Falls Church, VA 22041

Standard reference number	Title	Referenced in code section number
ICC/ANSI A117.1 - 98	Accessible and Usable Buildings and Facilities	907.9.1.4, 1010.1
ICC 300 - 02ICC	Standard on Bleachers, Folding and Telescopic Seating, and Grandstands	1024.1.1
IECC - 03	International Energy Conservation Code®	101.4.7, 1202.3.2, 1301.1.1, 1403.2
IFC - 03	International Fire Code®	3102.1, 3103.1
IMC - 03	International Mechanical Code®	201.3, 307.9, 406.4.2, 406.6.3, 406.6.5, 409.3, 412.4.6, 414.1.2, 414.1.2.1, 414.1.2.2, 414.3, 415.7.1.4, 415.7.2, 415.7.2.8, 415.7.3, 415.7.4, 415.9.11.1,416.3, 603.1, 707.2, 716.2.2, 716.5.4, 716.6.1, 716.6.2, 716.6.3, 717.5, 719.1, 903.2.12.1, 904.2.1, 904.11, 908.6, 909.1, 909.10.2, 1014.5, 1016.4.1, 1203.1, 1203.2.1, 1203.4.2,1203.4.2.1, 1203.5, 1209.3, 2304.5,
IRC - 03	International Residential Code®	101.2, 308.3, 308.5 1706.1.1, 3401.3

NCMA

National Concrete Masonry Association
2302 Horse Pen Road
Herndon, VA 20171-3499

Standard reference number	Title	Referenced in code section number
TEK 5-8A (1996)	Details for Concrete Masonry Fire Walls	Table 719.1(2)

NFPA

National Fire Protection Association
Batterymarch Park
Quincy, MA 02269

Standard reference number	Title	Referenced in code section number
11 - 05	Low Expansion Foam	904.7
12 - 08	Carbon Dioxide Extinguishing Systems	904.8, 904.11
12A - 04	Halon 1301 Fire Extinguishing Systems	904.9
13 - 07	Installation of Sprinkler Systems	704.12, 707.2, 903.3.1.1, 903.3.2, 903.3.5.1.1, 904 11, 907.8, 1621.3.10.1, 3104.5, 3104.9
13D - 07	Installation of Sprinkler Systems in One- and Two-family Dwellings and Manufactured Homes	903.1.2, 903.3.1.3, 903.3.5.1.1
13R - 07	Installation of Sprinkler Systems in Residential Occupancies Up to and Including Four Stories in Height	903.1.2, 903.3.1.2, 903.3.5.1.1, 903.3.5.1.2, 903.4
14 - 07	Installation of Standpipe, Private Hydrants and Hose System	905.2, 905.3.4, 905.4.2, 905.8

NFPA

National Fire Protection Association
Batterymarch Park
Quincy, MA 02269

Standard reference number	Title	Referenced in code section number
15-07	Water Spray Fixed Systems for Fire Protection	
16 - 07	Installation Foam-Water Sprinkler and Foam-Water Spray Systems	904.7, 904.11
17 - 02	Dry Chemical Extinguishing Systems	904.6, 904.11
17A - 02	Wet Chemical Extinguishing Systems	904.5, 904.11
20-07	Installation of Stationary Pumps for Fire Protection	
25-08	Inspection, Testing, and Maintenance of Water-based Fire Protection Systems	
30 - 08	Flammable and Combustible Liquids Code	415.3
30B-07	Manufacture and Storage of Aerosol Products	
31-06	Installation of Oil-burning Equipment	
32 - 07	Drycleaning Plants	415.7.4
33-07	Spray Application Using Flammable or Combustible Materials	
34-07	Dipping and Coating Processes Using Flammable or Combustible Liquids	
35-07	Manufacture of Organic Coatings	
40 - 07	Storage and Handling of Cellulose Nitrate Motion Picture Film	409.1
61 - 08	Prevention of Fires and Dust Explosions in Agricultural and Food Product Facilities	415.7.1
72 - 07	National Fire Alarm Code	505.4, 901.6, 903.4.1, 904.3.5, 907.2,907.2.1, 907.2.1.1, 907.2.10, 907.2.10.4, 907.2.11.2, 907.2.11.3, 907.2.12.2.3, 907.2.12.3, 907.4, 907.5, 907.9.2,907.10, 907.14, 907.16, 907.17, 911.1, 3006.5
80 - 07	Fire Doors and Fire Windows	302.1.1.1, 715.3, 715.4.6.1, 715.4.4, 715.4.7.2, 715.5, 1008.1.3.3
85 - 07	Boiler and Combustion System Hazards Code (Note: NFPA 8503 has been incorporated into NFPA 85)	415.7.1
90A-02	Installation of Air-conditioning and Ventilating Systems	
90B-06	Installation of Warm Air and Air-conditioning Systems	
92A-06	Smoke-control Systems Utilizing Barriers and Pressure Differences	
92B-05	Smoke Management Systems in Malls, Atria, and Large Spaces	
96-08	Ventilation Control and Fire Protection of Commercial Cooking Operations	
101 - 06	Life Safety Code	1024.6.2
105-07	Installation of Smoke Door Assemblies and Other Opening Protectives	
110 - 05	Emergency and Standby Power Systems	2702.1
111 - 05	Stored Electrical Energy Emergency and Standby Power Systems	2702.1
120 - 04	Coal Preparation Plants	415.7.104
211-09	Chimneys, Fireplaces, Vents and Solid Fuel-burning Appliances	2112.5
252 - 08	Standard Methods of Fire Tests of Door Assemblies	715.3.1, 715.3.2, 715.3.3, 715.3.4.1
253 - 06	Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source	406.6.4, 804.2, 804.3
257 - 07	Standard for Fire Test for Window and Glass Block Assemblies	715.3.3, 715.4, 715.4.1, 715.4.2
259 - 08	Test Method for Potential Heat of Building Materials	2603.4.1.10, 2603.5.3
265 - 07	Standard Method of Fire Tests for Evaluating Room Fire Growth Contribution of Textile Wall Coverings	803.6.1, 803.6.1.1, 803.6.1.2
268 - 07	Standard Test Method for Determining Ignitibility of Exterior Wall Assemblies Using a Radiant Heat Energy Source	1406.2.1, 1406.2.1.1, 1406.2.1.2, 2603.5.7
285 - 06	Standard Method of Test for the Evaluation of Flammability Characteristics of Exterior Non-load-bearing Wall Assemblies Containing Combustible Components	1407.10.4, 2603.5.5
286 - 06	Standard Method of Fire Test for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth	402.14.4, 803.2, 803.2.1, 803.5, 2603.4, 2603.8
288-07	Fire Tests of Floor Fire Door Assemblies Installed Horizontally in Fire Resistance-rated Floor Systems	
303-06	Fire Protection Standard for Marinas and Boatyards	
409 - 04	Standard on Aircraft Hangers	412.2.6, 412.4.5

NFPA

National Fire Protection Association
Batterymarch Park
Quincy, MA 02269

Standard reference number	Title	Referenced in code section number
418 - 06	Standard for Heliports	412.5.6
484-06	Combustible Materials, Metal Powders, and Metal Dust	415.6.1
651 - 98	Machining and Finishing of Aluminum and the Production and Handling of Aluminum Powders	415.7.1
654 - 06	Prevention of Fire & Dust Explosions from the Manufacturing, Processing, and Handling of Combustible Particulate Solids	415.7.1
655 - 07	Prevention of Sulfur Fires and Explosions	415.7.1
664 - 07	Prevention of Fires Explosions in Wood Processing and Woodworking Facilities	415.7.1
701 - 04	Standard Methods of Fire Tests for Flame-Propagation of Textiles and Films	802.1, 805.1, 805.2, 3102.3.1, 3105.3,
704 - 07	Standard System for the Identification of the Hazards of Materials for Emergency Response	414.7.2, 415.2
1124 - 06	Manufacture, Transportation, and Storage of Fireworks and Pyrotechnic Articles	415.3.1
2001 - 08	Clean Agent Fire Extinguishing Systems	904.10

NIST

National Institute of Standards and Technology
U.S. Department of Commerce
100 Bureau Dr. – Stop 3460
Gaithersburg, MD 20899-3460

Standard reference number	Title	Referenced in code section number
BMS 71 - 41	Fire Tests of Wood and Metal-framed Partitions	721.7
TRBM-44 - 46	Fire-resistance and Sound-insulation Ratings for Walls, Partitions and Floors	721.7

PCI

Precast Prestressed Concrete Institute
175 W. Jackson Boulevard, Suite 1859
Chicago, IL 60604-9773

Standard reference number	Title	Referenced in code section number
MNL 124 - 89	Design for Fire Resistance of Precast Prestressed Concrete	721.2.3.1, Table 721.2.3(4)
MNL 128 - 01	Recommended Practice for Glass Fiber Reinforced Concrete Panels	1903.8

RMA

Rubber Manufacturer's Association
1400 K Street N.W., Suite 900
Washington, DC 20005

Standard reference number	Title	Referenced in code section number
RP1 - 90	Minimum Requirements for Non-Reinforced Black EPDM Rubber Sheets	1507.12.2
RP2 - 90	Minimum Requirements for Fabric-Reinforced Black EPDM Rubber Sheets	1507.12.2
RP3 - 85	Minimum Requirements for Fabric-Reinforced Black Polychloroprene Rubber Sheets	1507.12.2

RMI

Rack Manufacturers Institute
8720 Red Oak Boulevard, Suite 201
Charlotte, NC 28217

Standard reference number	Title	Referenced in code section number
RMI (1997)	Design, Testing and Utilization of Industrial Steel Storage Racks	2208.1

SJI

Steel Joist Institute
3127 10th Avenue, North
Myrtle Beach, SC 29577-6760

Standard reference number	Title	Referenced in code section number
SJI - 1994	Standard Specification for Joist Girders	1604.3.3, 2206
K-Series Specification - 1994	Standard Specification for Open Web Steel Joists, K Series	2206
SJI - 1994	Standard Specification for Longspan Steel Joists, LH Series and Deep Longspan Steel Joists, DLH Series	2206

SPRI

Single-Ply Roofing Institute
77 Rumford Ave.Suite 3-B
Walthem, MA 02453

Standard reference number	Title	Referenced in code section number
ES-1 - 98	Wind Design Standard for Edge Systems Used with Low Slope Roofing Systems	1504.5
RP-4 - 88	Wind Design Guide for Ballasted Single-ply Roofing Systems	1504.4

TIA

Telecommunications Industry Association
2500 Wilson Boulevard
Arlington, VA 22201-3834

Standard reference number	Title	Referenced in code section number
TIA/EIA-222-F - 96	Structural Standards for Steel Antenna Towers and Antenna Supporting Structures	3108.4

TMS

The Masonry Society
3970 Broadway, Suite 201-D
Boulder, CO 80304

Standard reference number	Title	Referenced in code section number
0216 - 97	Standard Method for Determining Fire Resistance of Concrete and Masonry Construction Assemblies	Table 721.1(2), 721.1
402 - 02	Building Code Requirements for Masonry Structures	1405.5, 1405.5.3, 1405.9, 1604.3.4
602 - 02	Specification for Masonry Structures	1405.5.1, 1405.9.1

TPI

Truss Plate Institute
583 D'Onofrio Drive, Suite 200
Madison, WI 53719

Standard reference number	Title	Referenced in code section number
TPI 1 - 2002	National Design Standard for Metal-plate-connected Wood Truss Construction	2303.12

UL

Underwriters Laboratories, Inc.
333 Pfingsten Road
Northbrook, IL 60062

Standard reference number	Title	Referenced in code section number
10A - 98	Tin Clad Fire Doors - with Revisions through July, 1998	715.3
10B - 97	Fire Tests of Door Assemblies	715.3.2
10C - 98	Positive Pressure Fire Tests of Door Assemblies - with Revisions through November, 20017	15.3.1, 715.3.3
14B - 98	Sliding Hardware for Standard Horizontally Mounted Tin Clad Fire Doors - with Revisions through July, 2000	715.3
14C - 96	Swinging Hardware for Standard Tin Clad Fire Doors Mounted Singly and in Pairs	715.3
103 - 98	Factory-Built Chimneys, for Residential Type and Building Heating Appliances - with Revisions through March 1999	717.2.5
127 - 99	Factory-Built Fireplaces - with Revisions through November,1999	717.2.5
268 - 96	Smoke Detectors for Fire Protective Signaling Systems - with Revisions through January, 1999	407.6, 907.2.6.1
300 - 96	Fire Testing of Fire Extinguishing Systems for Protection of Restaurant Cooking Areas - with Revisions through December, 1998	904.11
555 - 96	Fire Dampers - with Revisions through October, 2000	716.3
555C - 96	Ceiling Dampers	716.3, 716.6.2
555S - 99	Smoke Dampers - with Revisions through December, 1999	716.3, 716.3.1.1
580 - 94	Test for Uplift Resistance of Roof Assemblies - with Revisions through February, 1998	1504.3.1, 1504.3.2
641 - 95	Type L Low-Temperature Venting Systems - with Revisions through April, 1999	2113.11.1.4
790 - 97	Tests for Fire Resistance of Roof Covering Materials - with Revisions through July, 1998	1505.1, 2603.6, 2610.2, 2610.3
864 - 96	Control Units for Fire Protective Signaling Systems - with Revisions through March, 1999	909.12
1040 - 96	Fire Test of Insulated Wall Construction - with Revisions through April, 2001	1407.10.3, 2603.4, 2603.8
1256 - 98	Fire Test of Roof Deck Construction - with Revisions through March, 2000	1508.1, 2603.3, 2603.4.1.5
1479 - 94	Fire Tests of Through-Penetration Firestops	712.3.1.2, 712.4.1.2
1715 - 97	Fire Test of Interior Finish Material	1407.10.2, 1407.10.3, 2603.4, 2603.8
1777 - 98	Chimney Liners - with Revisions through July, 1998	2113.11.1, 2113.19
1784 - 95	Air Leakage Tests of Door Assemblies	707.14.1, 710.5.2, 715.3.3, 715.3.5.1
1897 - 98	Uplift Tests for Roof Covering Systems - with Revisions through December, 1999	1504.3.1
1975 - 96	Fire Test of Foamed Plastics Used for Decorative Purposes	402.10, 402.14.5
2079 - 98	Tests for Fire Resistance of Building Joint Systems	702 1, 712.3
2200 - 98	Stationary Engine Generator Assemblies	2702.1.1
2390 - 04	Test Method fro Measuring the Wind Uplift Coefficients for Asphalt Shingles	1504.2.1, 1609.5.2

ULC

Underwriters' Laboratories of Canada
7 Crouse Road
Scarborough, Ontario, Canada MIR 3A9

Standard reference number	Title	Referenced in code section number
S 102 - M88	Surface Burning Characteristics of Building Materials and Assemblies	719.4

USC

United States Code
c/o Superintendent of Documents
U.S. Government Printing Office
Washington, DC 20402-9325

Standard reference number	Title	Referenced in code section number
18 USC Part 1, Ch.40	Importation, Manufacture, Distribution and Storage of Explosive Materials	307.2

WDMA

Window & Door Manufacturers Association
1400 East Touhy Avenue, Suite 470
Des Plaines, IL 60018

Standard reference number	Title	Referenced in code section number
AAMA/NWWDA101/I.S.2 - 97	Voluntary Specifications for Aluminum, Vinyl (PVC) and Wood Windows and Glass Doors	1627.5.1
AAMA/NWWDA101/I.S.2/NAFS - 02	Voluntary Performance Specification for Window, Skylights and Glass Doors	1627.5.1

(780 CMR 36.00 THROUGH 50.00: RESERVED)

NON-TEXT PAGE

780 CMR 110.00

780 CMR 110.R1

CONCRETE TESTING LABORATORIES LICENSING

(Note: *780 CMR 110.R1 is unique to Massachusetts*)

780 CMR 110.R1.1 Administration

110.R1.1.1 Scope. Provisions of 780 CMR 110.R1.1 shall govern the licensing of concrete testing laboratories.

110.R1.1.2 Definitions. The following words terms shall, for the purpose of 780 CMR 110.R1 and as used elsewhere in 780 CMR, have the meaning indicated in 780 CMR 110.R1.1.2:

ACCREDITED LABORATORY. A laboratory which has been licensed in accordance with 780 CMR 110.R1 by the State Board of Building Regulations and Standards (BBRS).

BBRS. State Board of Building Regulations and Standards (BBRS).

BRANCH LABORATORIES. A branch of a testing laboratory physically removed from the location of the headquarters or main testing facility of the testing laboratory.

LABORATORIES. Testing laboratory, branch laboratory and project laboratory.

PERSON. Individual, partnership, corporation, trust, joint venture, etc.

PROJECT LABORATORY. A temporary on-site facility providing concrete testing services for a specific project under the direction of a testing or branch laboratory licensed by the Commonwealth of Massachusetts.

TESTING AGENCY. National Institute of Standards and Technology (NIST), Cement and Concrete Reference Laboratory (CCRL), the Army Corps of Engineers or other agency designated by the BBRS.

TESTING LABORATORY. A proprietorship, corporation, partnership or agency which conforms to the requirements of ASTM E 329-72 as modified in 780 CMR 110.R1

110.R1.1.3 Licensing. All laboratories defined by 780 CMR 110.R1.1.2 as testing laboratories, branch laboratories and project laboratories which are engaged in the testing of concrete and concrete materials for use in buildings and structures subject to the construction control provisions of 780 CMR 116.0 will be licensed by the BBRS in accordance with 780 CMR 110.R1.

110.R1.1.4 Application for Licensing. Each laboratory desiring to obtain such license shall make application to the BBRS upon such form and in such manner as the BBRS shall prescribe and shall furnish evidence satisfactory to the BBRS that the laboratory equipment meets the requirements of 780 CMR 110.R 1.2 and its management personnel are qualified in accordance with 780 CMR 110.R 1.4 and .5. Such application shall also include payment of the licensing fee set forth in 780 CMR 110.R1.1.8.

110.R1.1.5 Prequalifying Agency. The BBRS hereby designates the CMSB as its prequalifying agency, provided, however, that the BBRS may revoke such designation at any time, and may designate any other agency or agencies which it deems qualified, from time to time, to act as its prequalifying Agency. The prequalifying agency shall examine, or cause to be examined, the evaluation performed by the testing agency and the personnel on each Concrete Testing Laboratory application and make its recommendation to the BBRS regarding such license.

110.R1.1.6 Testing Agency. The BBRS hereby designates the Cement and Concrete Reference Laboratory of the National Institute of Standards and the Army Corps of Engineers as the agencies to examine and evaluate all laboratories desiring to be licensed in the practice of concrete testing, provided, however, that the BBRS may revoke such designation at any time, and may designate any other agency or agencies which it deems qualified, from time to time, to act as its testing agency.

110.R1.1.7 Notification of Testing and Testing Results. The testing agency shall notify the applicant of the date for evaluation and shall provide the audited laboratory with a report of audit findings.

Note: Unless specific permission has been granted by the BBRS, accredited laboratories must have the capability to test both concrete and concrete aggregate.

110.R1.1.7.1 Audit Findings Response. The audited laboratory shall request that the testing agency forward a copy of the audit report to the BBRS.

The audited laboratory shall prepare formal responses to each and all audit findings and issue such response report to the BBRS for review (also see 780 CMR 110.R1.3).

110.R1.1.8 Licensing Fee. The fee for licensing shall be $150 *per annum* or in accordance with the fee schedule established by the BBRS from time to time.

110.R1.1.9 Number and Classification. Each laboratory so licensed by the BBRS shall be issued a number and classification.

110.R1.1.10 Renewals. Commencing January 1, 1978, all licenses issued shall expire on December 31st of the year issued. Within 60 days before the expiration date of any such license, the Administrator of the BBRS shall forward to each laboratory so licensed an application form for renewal. Said renewals shall be returned to the BBRS by December 31st. The said Administrator, upon receipt of the completed form and fee, shall renew the license for a period of one year or notify such applicant of the BBRS's refusal with reasons thereof.

110.R1.1.11 Penalties. Any such person and/or laboratory who fails to comply with the requirements of 780 CMR 110.R1 or who files a false report shall be subject to the penalties and actions as prescribed in the 780 CMR 118.0.

780 CMR 110.R1.2 LABORATORY LICENSING REQUIREMENTS

110.R1.2.1 ASTM Testing Requirements. Except as modified in 780 CMR 110.R1, all testing laboratories including branch laboratories shall conform to ASTM E 329-72, Sections 5 and 6, standard requirements for testing of concrete and its constituent materials.

Exception: The following sections of ASTM E 329-72 shall not apply:

Sections 2.2; 2.3; 2.7; 3.2.7; 3.3; 3.4 C360 of 6.2; 7; 8; 9 and 10.

110.R1.2.2 ASTM Equipment and Personnel Requirements. All laboratories subject to 780 CMR 110.R1 shall be approved and licensed in accordance with the ASTM E 329-72 standard for the performance of those functions recommended in standard ASTM E 329-72, for equipment and personnel, as modified in 780 CMR 110.R1.

780 CMR 110.R1.3 PREQUALIFICATION REQUIREMENTS FOR LABORATORIES

110.R1.3.1 Evaluation.

1. Testing and branch laboratories subject to 780 CMR 110.R1 shall be examined and evaluated, upon notification from the BBRS, by a testing agency designated by the BBRS. The interval between such examination and evaluation shall not exceed three years.
2. Project laboratory equipment which is used in the testing of concrete materials for use in buildings and structures subject to the provisions of 780 CMR shall conform to the requirements of ASTM E 329 as modified by 780 CMR 110.R1.2.
3. Reports of evaluations by the testing agency shall be filed with the BBRS within ten days of receipt of the report by the laboratory, unless a waiver is granted by the laboratory to have the report sent directly to the BBRS by the testing agency.
4. Laboratory deficiencies cited in the report of the testing agency shall be corrected within 30 days of the date of issue of the report and shall be so certified by an affidavit submitted by the laboratory on a form supplied by the BBRS.

110.R1.3.2 Review of Deficiencies. Laboratories which fail to meet the requirements of 780 CMR 110.R1 .3. I items 3. and 4. shall be subject to review and revocation of their license by the BBRS.

110.R1.3.3 Testing Machines. Compression testing machines used for testing materials subject to 780 CMR 110.R1 shall be calibrated and verified, with equipment traceable to the National Institute of Standards and Technology (NIST), at least annually or as required by the BBRS, and the results submitted to the BBRS.

780 CMR 110.R1.4 PERSONNEL

The management and supervision of each laboratory subject to 780 CMR 110.R1 shall be in accordance with the following requirements:

110.R1.4.1 Required. Each accredited licensed concrete testing laboratory must have an individual approved by the BBRS in each of three distinctly different categories: director of testing services, supervisory laboratory technician and supervisory field technician. An individual may fill more than one position at the particular laboratory if he or she meets all the qualifications for each position, but he or she may not fill positions concurrently at a separate (branch or project) laboratory. The project laboratory must have a full-time resident supervisory laboratory technician qualified in accordance with 780 CMR 110.R1.

110.R1.4.2 Filing of Qualifications. Each individual being certified for a position must submit his or her credentials and qualifications under penalty of perjury with signature notarized. Individuals applying for certification in more than one category must file separate applications for each position as described in 780 CMR 110.R 1.5. Application for certification shall be filed within 30 days of employment for such duties. It is the responsibility of the director of testing services to notify the BBRS within seven days of any vacancy of any position. Any vacant position shall be filled within 30 days.

780 CMR 110.R1.5 QUALIFICATIONS

110.R1.5.1 Qualifications for Director of Testing Services. The testing services of each laboratory (main, branch or project) shall be under the direction of a director of testing services who shall be a full-time resident employee of that laboratory and shall be qualified in accordance with anyone of the following three sets of requirements:

1. He or she shall be a professional engineer, registered in the Commonwealth of Massachusetts with a least five years of experience in responsible charge of work related to structural engineering, construction engineering or construction materials testing. He or she shall be subject to demonstrate his or her ability to interpret the results of tests of concrete and concrete aggregates as stated in ASTM E 329-72; or
2. He or she shall have a Bachelor's Degree in Engineering from an accredited institution and an additional total of three years of experience performing tests on concrete and concrete materials which shall include two years as a laboratory technician or supervisor. He or she shall be subject to demonstrate his or her ability to interpret the results of tests of concrete and concrete aggregates as stated in ASTM E 329-72; or
3. He or she shall have at least eight years experience including five years of experience as a laboratory technician or supervisor and shall be subject to demonstrate his or her ability to interpret the results of tests of concrete and concrete aggregates as stated in ASTM E 329-72.

110.R1.5.2 Qualifications for Supervisory Laboratory Technician. A supervisory laboratory technician shall have at least five years of experience performing tests on construction materials including concrete and concrete aggregates. He or she shall be subject to demonstrate his or her ability to perform correctly tests of concrete and aggregates as stated in ASTM E 329-72. "Class A" accreditation by the prequalifying agency shall be required as qualification for concrete only. (*See* 780 CMR 110.R2 *Concrete Testing Personnel Licensing*.)

110.R1.5.3 Qualifications for Supervisory Field Technician. A supervisory field technician shall have at least five years of experience performing tests on construction materials including concrete. He or she shall be subject to demonstrate either by oral or written examination, or both, his or her ability to perform correctly the tests of concrete as stated in ASTM E 329-72. "Class A" accreditation by the prequalifying agency shall be required as qualification for concrete only. (*See* 780 CMR 110.R2 *Concrete Testing Personnel Licensing*.)

780 CMR 110.R1.6 PROJECT AFFIDAVIT

In accordance with 780 CMR 110.12, those structures subject to control as required in 780 CMR 116.0, affidavits must be submitted with the building permit application that the individuals and testing laboratories responsible for carrying out the duties of 780 CMR 116.0 have been licensed and registered by the BBRS.

110.R1.6.1 Affidavit. In accordance with 780 CMR 110.R1.6, an affidavit shall be furnished to the building department by the licensed laboratory and shall be provided by the licensed laboratory for each building project.

110.R1.6.2 Notice of Termination. The building official shall receive written notification of the termination of laboratory functions certifying that the owner has also been so notified. Such termination shall be effective no earlier than three working days from the notification received by the building official.

110.R1.6.3 Successor Laboratory. If concrete testing is to be continued for the said project by a successor laboratory, such notice shall be given to the building official and a new project affidavit shall be filed with the building official.

780 CMR 110.R1.7 REVOCATION AND SUSPENSION PROCEDURES

110.R1.7.I Revocation and Suspension. The BBRS on its own initiative or upon the recommendation of the CMSB may suspend or revoke the license of any testing laboratory or project laboratory found to be in noncompliance with 780 CMR 110.Rl, 780 CMR, or the standards of good practice. Notice of suspension or revocation of such license shall be in writing with the reasons for suspension or revocation clearly set forth therein, and served in accordance with the 780 CMR 118.6.

110.R1.7.2 Notice and Conference. Prior to suspension, revocation or refusal to renew the license of an accredited laboratory, written notice of such intent shall be served by the Construction Materials Safety Board of BBRS in accordance with 780 CMR 118.6. Within ten calendar days of receipt of such notice, the affected accredited laboratory may request a conference before a three-member panel designated by the chairman of the Construction Materials Safety Board; said panel will hear facts and make its recommendations to the CMSB, who in turn shall report such findings to the BBRS for BBRS consideration and action.

110.R1.7.3 Effect of Suspension or Revocation. Upon suspension or revocation ofthe license, the accredited laboratory shall immediately cease engaging in the testing of concrete and concrete materials for use in buildings and structures which are subject to the provisions of 780 CMR 116.0 and no action brought before the Board of Appeals as specified in 780 CMR 110.R1.8.1 or in any court of competent jurisdiction shall stay the said suspension or revocation unless said Board of Appeals or court shall issue an order for a stay of the BBRS's suspension or revocation.

780 CMR 110.R1.8 APPEALS

110.R1.8.I Building Code Appeals Board. Any laboratory or individual aggrieved by the suspension or revocation of its license or by an interpretation, order, requirement, direction or failure to act under

780 CMR 110.R1 may appeal to the State Building Code Appeals Board as provided in 780 CMR 122.0; however, entry of an appeal from the BBRS's order of revocation or suspension shall not stay such revocation or suspension unless so ordered by the State Building Code Appeals Board in a preliminary hearing conducted expressly for the purpose of a stay in accordance with that part of 780 CMR 122.3.2 dealing with procedure required for a hearing on such stay.

780 CMR 110.R2

CONCRETE FIELD TESTING TECHNICIAN LICENSING

(Note: *780 CMR 110.R.2 is unique to Massachusetts*)

780 CMR 110.R2.1 ADMINISTRATION

110.R2.1.1 Title. As authorized by M.G.L. c. 143, §§ 93 through 100, 780 CMR 110.R2 is adopted for Concrete Field Testing Technician.

110.R2.1.2 Definitions. Unless otherwise expressly stated in 780 CMR, the following terms, for the purpose of 780 CMR 110.R2, shall have the meaning indicated in 780 CMR 110.R2.1.2.

CONCRETE FIELD TESTING TECHNICIAN. A person issued a Grade 1 license by the American Concrete Institute (ACI) authorizing such person to test/inspect concrete.

TESTING AGENCY. Massachusetts Construction Industry Board (MCIB) or other official "local sponsoring group" of ACI.

110.R2.1.3 Licensing. All personnel engaged in field testing/inspection of concrete for use in buildings and structures subject to the construction control provisions of 780 CMR 116.0 shall be licensed by ACI as a Concrete Field Testing Technician - Grade 1 in accordance with ACI's "Certification Policies for Concrete Field Testing Technician - Grade 1" and 780 CMR 110.R2.

110.R2.1.4 Application for Licensing. Applicants shall contact and follow the policies and procedures of the Testing Agency and ACI to be licensed in accordance with 780 CMR 110.R2.

110.R2.1.5 Examination. Applicants shall contact the Testing Agency regarding applications, fees and exam schedules. The exam includes a written and practical "hands-on" component.

110.R2.1.6 Notification of Examination and Examination Results. The testing agency provides the time and place for the examination. ACI provides exam results directly to the applicant.

110.R2.1.7 Fees. Application, testing and license fees are paid to the Testing Agency and/or ACI.

110.R2.1.8 Renewals. Licenses shall be renewed according to the policies of ACI.

NON-TEXT PAGE

780 CMR 110.R3

MANUFACTURED BUILDINGS, BUILDING COMPONENTS AND MOBILE HOMES

(Note: This Regulation is unique to Massachusetts)

PART I—GENERAL

780 CMR 110.R3.1 ADMINISTRATION

110.R3.1.1 Title. The BBRS, Massachusetts Board of Fire Prevention Regulations, Massachusetts Board of State Examiners of Electricians, and the Massachusetts Board of State Examiners of Plumbers and Gas Fitters herewith adopt the Rules and Regulations for Manufactured Buildings, Manufactured Building Components and Manufactured Homes.

110.R3.1.2 Definitions. Unless otherwise expressly stated in 780 CMR the following terms shall, for the purpose of 780 CMR 110.R3, have the meaning indicated in 780 CMR 110.R3.1.2.

APPROVAL. Approval by the State Board of Building Regulations and Standards (BBRS).

BUILDING SYSTEM. Plans, specifications and documentation for a system of manufactured buildings or for a type or a system of manufactured building components, which may include structural, electrical, mechanical, plumbing and fire protection systems and other systems affecting health and safety, including variations which are submitted as part of the building system.

CERTIFICATION. Any manufactured building, manufactured building component or manufactured home which meets the provisions of the applicable Codes and Rules and Regulations pursuant thereto; and which has been labeled accordingly.

CODE. 780 CMR or Specialized Codes as defined.

DEALER OF MODULAR HOMES. (For purposes of this definition, a modular home is a single or multiple, single-family residential manufactured building.) Any individual, organization or firm engaged in the retail selling, or offering for sale, brokering, or distribution of modular homes, primarily to a person who in good faith, purchases or leases such home for purposes other than resale. Such individual, organization or firm shall be registered with the Board of Building Regulations and Standards in accordance with policies established therefore.

DEPARTMENT - DPS. The Department of Public Safety, Division of Inspections.

INSPECTION AGENCY. Independent agency, sometimes referred to as "third-party agency," retained by the manufacturer and approved by BBRS to perform inspections and evaluations of building systems, compliance assurance programs, manufactured buildings, and manufactured building components.

INSTALLATION. The process of affixing, or assembling and affixing a manufactured building, manufactured building component or manufactured home on the building site, and connecting it to utilities, and/or to an existing building. Installation may also mean the connecting of two or more manufactured housing units designed and approved to be so connected for use as a dwelling.

INSTALLER OF MANUFACTURED BUILDINGS. An individual who, on the basis of training and experience, has been certified by a specific manufacturer of manufactured homes as competent to supervise the placement and connection required to install the manufactured homes of that manufacturer. Said certification by the manufacturer shall be in writing; additionally, the certified installer shall possess picture identification in the form of a driver's license or other picture identification acceptable to the building official in accordance with the *Sixth Edition of the Massachusetts State Building Code*, 780 CMR 108.3.5.1.

LABEL. An approved device or seal evidencing certification in accordance with the applicable Codes and Rules and Regulations promulgated pursuant thereto.

LOCAL ENFORCEMENT AGENCY. A department or agency in a municipality charged with the enforcement of 780 CMR and appropriate specialized codes which include, but are not limited to, 248 CMR (the State Plumbing and Gas Fitting code) and 527 CMR 12.00 (the State Electrical Code).

MANUFACTURED BUILDING. Any manufactured building which has concealed elements, such as electrical, mechanical, plumbing, fire protection, insulation, and other systems affecting health and safety, and which is manufactured or assembled in accordance with 780 CMR and pertinent regulations, in manufacturing facilities, on or off the building site. Also, any manufactured building as defined above which does not have concealed elements, but which has been approved by the BBRS at the request of the manufacturer. "Manufactured building" does not mean "manufactured home."

MANUFACTURED BUILDING COMPONENT. Any manufactured subsystem, manufactured subassembly, or other system designed for use in or as part of a structure having concealed elements such as electrical, mechanical, plumbing and fire protection systems and other systems affecting health and safety.

MANUFACTURED HOMES (Housing). As defined in 24 CFR, Part 3280.2; a structure, transportable in one or more sections, which in the traveling mode, is eight body feet or more in width or forty body feet or more in length, or, when erected on site, is 320 or more square feet, and which is built on a permanent chassis and designed to be used as a dwelling with or without a permanent foundation when connected to the required utilities, and includes the plumbing, heating, air-conditioning, and electrical systems contained therein. Calculations used to determine the number of square feet in a structure will be based on the structure's exterior dimensions measured at the largest horizontal projections when erected on site. These dimensions will include all expandable rooms, cabinets, and other projections containing interior space, but do not include bay windows. (*See* 24 CFR, Part 3280.2 for a more detailed description of manufactured homes as defined by the Department of Housing and Urban Development.)

RECERTIFIED MANUFACTURED BUILDING. Any manufactured building as herein defined that was previously designed and constructed to conform with requirements of a particular use group or groups for use at a site and that subsequently is to be relocated to a different site. Such buildings, also known as relocatable units, shall be inspected by the responsible third-party inspection agency and recertified in accordance with 780 CMR and 780 CMR 110.R3 as applicable to ensure compliance with the new use group or groups if such use group or groups has changed or to requirements of the original use group or groups if not changed prior to being set at the new location.

SPECIALIZED CODE. All building codes, rules or regulations pertaining to building construction, reconstruction, alteration, repair or demolition promulgated by and under the authority of the various agencies which have been authorized from time to time by the General Court of the Commonwealth of Massachusetts. The specialized codes shall include, but not be limited to, 248 CMR (the State Plumbing and Gas Fitting Code)and 527 CMR 12.00 (the Electrical Code).

STATE ADMINISTRATIVE AGENCIES. Boards, commissions, departments or agencies authorized to promulgate, adopt and amend codes and rules and regulations relating to buildings and structures and parts thereof and limited to the BBRS, Massachusetts Board of Fire Prevention Regulations, Massachusetts State Examiners of Electricians, and the Massachusetts Board of State Examiners of Plumbers and Gas Fitters.

STATE ENFORCEMENT AGENCIES. Boards, commissions, departments or agencies authorized to enforce the provisions of the codes and rules and regulations which have been promulgated, adopted and amended and which relate to buildings or structures and parts thereof and limited to the Department of Public Safety, Massachusetts Board of State Examiners of Plumbers and Gas Fitters, and the Massachusetts State Examiners of Electricians.

110.R3.1.3 Scope.

1. 780 CMR 110.R3 shall govern the design, manufacture, handling, storage, transportation and installation of manufactured buildings, and manufactured building components intended for installation in this State and/or manufactured in this State for shipment to any other state in which such building, building components, or manufactured homes and the labels thereon are accepted.
2. The Federal Manufactured Home Construction and Safety Standards promulgated by the Department of Housing and Urban Development govern the design, manufacture, handling, storage and transportation of manufactured homes for installation in this state.
3. Subject to local zoning ordinances and by-laws, manufactured buildings, manufactured building components or manufactured homes may be sold for, delivered to, or installed on, building sites located in any jurisdiction of this State if such buildings, building components or manufactured homes have been approved and certified pursuant to the applicable Codes and 780 CMR 110.R3.

110.R3.1.4 Administration and Enforcement. The BBRS and the State Enforcement Agencies shall enforce all provisions of 780 CMR 110.R3. The State Enforcement Agencies and the Local Enforcement Agencies shall have the responsibility for evaluating building systems and performing inspections of manufactured buildings and manufactured building components to enforce compliance with 780 CMR 110.R3 and the applicable codes. The State Enforcement Agencies and the local enforcement agencies shall deem acceptable manufactured buildings, manufactured building components, building systems and compliance assurance programs labeled and certified by inspection agencies approved by the BBRS and those manufactured homes certified as in conformance with the Federal standards by the application of the applicable required HUD label.

110.R3.1.5 Authorization of Third-party Inspections. Upon recommendation of the State Enforcement Agencies, the BBRS may authorize inspection agencies, sometimes referred to as third party inspection agencies, to perform all or part of the inspection and certification of manufactured buildings and manufactured building components, building systems and compliance assurance programs, including either or both the issuance and the attachment of labels thereto. The BBRS may suspend or revoke such authorization for cause.

110.R3.1.6 Approvals and Compliance. Upon the recommendation of the State Enforcement Agencies, the BBRS may approve building systems and compliance assurance programs which comply with the codes, standards, specifications, requirements and 780 CMR 110.R3.

110.R3.1.7 Time of Manufacture. For purposes of 780 CMR 110.R3, a manufactured building, manufactured building component or manufactured home is deemed to be manufactured at such time as the label as herein described is duly issued label is attached to it in accordance with the approved compliance assurance program.

110.R3.1.8 Retroactive Changes. No changes in the codes, standards, specifications and requirements of 780 CMR 110.R3 shall apply retroactively.

110.R3.1.9 Amendments. The State Administrative Agencies shall notify the BBRS, and the BBRS shall notify all interested parties including State Enforcement Agencies, inspection agencies, manufacturers with approved building systems, and local governmental jurisdictions of all amendments to 780 CMR 110.R3, and each manufacturer shall have no more than 180 days following the sending of notification to submit to the BBRS compliance assurance program revisions in order to comply with such amendments. Where imminent danger to life safety is involved, the State Administrative Agencies may require that immediate effect be given such amendments to the codes, standards, specifications and requirements so adopted.

780 CMR 110.R3.2 COMPLIANCE ASSURANCE PROGRAMS

110.R3.2.1 Approval. In order to obtain approval for manufactured buildings or manufactured building components a manufacturer shall submit a building system for evaluation to the BBRS for approvals in accordance with 780 CMR 110.R3.

110.R3.2.2 Suitability. Prior to a full evaluation, the State Enforcement Agencies shall determine that building systems and/or the application for approval of the compliance assurance program submitted to it are suitable for processing. In the event that the application is found to be unsuitable for processing, the applicant shall be notified in writing of such unsuitability and the basis thereof, within 30 days of the date the application is received by the BBRS. In such event, all but $25.00 of the fee will be returned and the findings of unsuitability will be without prejudice. Any subsequent submission shall be treated as a new application.

110.R3.2.3 Requisites. The State Enforcement Agencies may require tests to determine whether a compliance assurance program meets the codes, standards and requirements of the evaluation of plans, specifications and documentation. The procedures used shall be reviewed and evaluated by the BBRS in accordance with 780 CMR 110.R3. The costs of such tests shall be borne by the applicant.

110.R3.2.4 Notification of Disapproval. In the event a compliance assurance program is disapproved by the BBRS, the BBRS shall notify the applicant with a written explanation of the reasons for such disapproval thereto.

110.R3.2.5 Approval – Evidence. Approval of a compliance assurance program shall be evidenced by a letter of certification issued by the BBRS.

110.R3.2.6 Approval – Report. The State Enforcement Agencies shall prepare and the BBRS shall issue to the applicant a building system approval report which shall include therein any conditions imposed for its use.

110.R3.2.7 Approval – Variations. A building system and compliance assurance program or any amendment there to which has been approved, shall not be varied in any way without prior written authorization by the BBRS. All amendments shall be in writing and shall be made a part of the written record of the approval.

110.R3.2.8 Amendments – Proposed. Amendments to compliance assurance programs may be proposed by submitting to the BBRS for its approval, appropriate plans, specifications, or documentation showing the effect of the proposed amendment on each building system and the required fee.

110.R3.2.9 Compliance Assurance Program. A manufacturer shall obtain approval from the BBRS of a compliance assurance program for his building system. Buildings or building components shall be manufactured in accordance with an approved program in order to be certified. Compliance assurance programs shall be submitted to the BBRS for its approval in accordance with 780 CMR 110.R3.

780 CMR 110.R3.3 CERTIFICATION

Manufactured buildings or manufactured building components or manufactured homes, accepted by the State Enforcement Agencies and an inspection agency as having been manufactured according to an approved building system and an approved compliance assurance program, shall be certified by the BBRS upon the recommendation of the State Enforcement Agencies as complying with the requirements of the applicable codes and 780 CMR 110.R3. Certification shall be evidenced by the issuance of a label by the Board of Building

Regulations and Standards and by attachment of the label to each certified manufactured building or manufactured building component (or groups of components).

110.R3.3.1 Manufacturer's Data Plate.

110.R3.3.1.1 Contents. The following information shall be placed directly or by reference on one or more permanent manufacturer's data plates in the vicinity of the electrical distribution panel, or in some other designated location acceptable to the State Enforcement Agencies, on the manufactured building or manufactured building component where it will be readily accessible for inspection.

1. Manufacturer's name and address;
2. Serial number of the unit;
3. Label serial number;
4. Name and date of applicable building, plumbing, gas and electrical codes and issue of their accumulative supplements complied with;
5. Model designation and name of manufacturer of major factory-installed appliances;
6. Identification of permissible type of gas for appliance and directions for water and drain connection;
7. Snow, wind, seismic and other live loads;
8. Electrical ratings - instructions and warnings on voltage;
9. Special conditions or limitations on use of the units, including unsuitability for areas in which specified environmental conditions prevail;
10. Methods of assembly or joining multiple units;
11. Type of construction, including fire rating, occupancy class, and interior finish flame spread class;
12. Building height and story limitation;
13. Floor area; and
14. Minimum side yard requirements for fire rating.

If, in the opinion of the State Administrative Agencies, the shape or size of a building component is such that this information cannot be attached to it permanently, the information may be placed in a manual crated with the component or on a tag attached to the crate in which the component is shipped, if the information is not such that the future occupant of the building should know it. If the occupant will need to know the information, it shall be contained in a manual which shall be presented to the occupant upon transfer of possession. If life safety is involved, the item in question shall be plainly labeled.

110.R3.3.2 Labels. Each manufactured building or manufactured building component which is certified pursuant to the applicable codes and 780 CMR 110.R3, shall have permanently attached thereto, in a visible location as shown on the approved building system, an approved label which cannot be removed therefrom without destroying such label. Said label shall be made part of the permanent record for the manufactured building or manufactured building component, copies of which shall be retained by the manufacturer, the BBRS and the municipal and\or state building department where the manufactured building product is installed. Manufactured building that are to be used as a re-locatable unit, shall be issued a new label upon submission of a new Third Party Inspection Agency Compliance Report in attestation that the re-locatable unit has been inspected and meets the requirements of all applicable Massachusetts codes and requirements of 780 CMR 110.R3.

110.R3.3.2.1 Contents. An approved label shall bear the following information.

1. The statement "This label certifies that this building (or building component) has been manufactured in accordance with an approved building system and compliance assurance program which has been approved by the Commonwealth of Massachusetts Board of Building Regulations and Standards. Said manufactured building or manufactured building component has been inspected by

________________________________;
Name of Third-Party Inspection Agency

________________________________;
Name of Third-Party Inspector

a. Label serial number.
b. Building system approval number.
c. Manufacturer's serial number.
d. The words "See data plate located on."
f. Date of manufacture.

At the direction of the BBRS labels and data plates may be limited in size and content for components whose shape and size does not permit the full information to be placed thereon.

110.R3.3.2.2 Issuance of Labels. The approved label shall be issued by the BBRS in accordance with the following.

1. If the BBRS delegated the issuance of labels to an inspection agency, the agency shall be required to obtain approval from the BBRS for the manner in which they are handled;
2. Labels must be serially numbered;
3. A manufacturer's compliance assurance program submitted in accordance with 780 CMR 1 10.R3 shall include requirements for issuance, possession of, attachment of, and accounting for all labels to assure that labels are attached only to manufactured buildings, manufactured building components, or manufactured homes manufactured pursuant to

an approved building system and inspected pursuant to an approved compliance assurance program; and

4. Upon request of the inspection agency, the BBRS may determine that the manufacturer's record of compliance is such that the inspection agency need not maintain an inspector in a given plant at all times, inspection agency may entrust labels to the custody of one or more employees of the manufacturer, who shall be charged with controlling the use of the such labels. Such employees shall not be given custody of more labels than are necessary. If the conditions of custody are violated, the BBRS or an inspection agency shall immediately regain possession of all labels that have not been applied to the manufactured buildings or manufactured building components and shall take such further action with respect to future labeling, as it may deem necessary to assure compliance with the applicable codes and 780 CMR 110.R3.

110.R3.3.3 Records of Labels. Permanent records shall be kept of the handling of all labels, indicating at least how many labels have been applied issued to manufacturers for their to manufactured buildings or manufactured building components (or groups of components), and which labels have been applied assigned to which buildings or building components, the disposition of any damaged or rejected labels, and the location and custody of all unused labels. Such records shall be maintained by the manufacturer or by the inspection agency and a copy of such records covering attachment of each label shall be sent to the Board of Building Regulations and Standards on the tenth of each month and the BBRS shall forward all such records to the State Enforcement Agencies.

110.R3.3.4 Attachment of Labels. The inspection agency shall attach in numerical sequence labels to manufactured buildings or manufactured building components manufactured in accordance with an approved building system and meeting the requirements of an approved compliance assurance program.

Manufacturers shall attach labels in the same manner to manufactured buildings or building components manufactured in accordance with an approved building system and meeting the requirements of an approved compliance assurance program.

Manufacturers shall attach labels in the same manner to manufactured buildings or building components manufactured in accordance with a approved compliance assurance program, if custody of the labels has been entrusted to them in accordance with 780 CMR 110.R3.3.3.4.

110.R3.3.5 Suspension and Revocation. The BBRS may suspend or revoke, or cause to be suspended or revoked, the certification of any manufactured building or manufactured building component which the State Enforcement Agencies or an inspection agency finds not to comply with the applicable codes or 780 CMR 110.R3, or which has been manufactured pursuant to a building system or a compliance assurance program for which approval has been suspended or revoked, or which has not been manufactured in accordance with the approved compliance assurance program. The State Enforcement Agencies shall withhold or void a label or shall remove or cause to be removed, labels from any such manufactured building, manufactured building component or manufactured home until it is brought into compliance with the applicable codes and 780 CMR 110.R3. Notice of suspension or revocation of certification shall be in writing with the reasons for suspension or revocation clearly set forth therein.

1. Upon suspension or revocation of the approval of any building system or compliance assurance program, no further labels shall be issued, assigned and/or attached to any manufactured buildings or manufactured building components manufactured pursuant to the building system or compliance assurance program with respect to which the approval was suspended or revoked. Upon termination of such suspension or revocation, labels may again be issued and/or assigned be attached to the manufactured building or manufactured building components manufactured after the date approval was reinstated. Should any building or building component have been manufactured during the period of suspension or revocation, it shall not be issued a label unless the State Enforcement Agencies or inspection agency have inspected such building or building component and is satisfied that all requirements for certification have been met. If the State Enforcement Agency acts under 780 CMR 110.R3.3.5, it must notify the inspection agency.

2. The manufacturer shall return all labels allocated for a manufactured building or manufactured building component to the BBRS no later than 30 days from the effective date of any suspension or revocation of the State Enforcement Agencies or inspection agency, of the building system or compliance assurance program pursuant to which the manufactured building or manufactured building component is being manufactured. The manufacturer shall also return to the BBRS all labels which it determines for any reason are no longer needed.

110.R3.3.6 Variations of Certified Units. Manufactured buildings, manufactured building components or manufactured homes certified and labeled pursuant to the applicable codes and 780 CMR 110. R3 shall not be varied in any way prior to the issuance of a certificate of occupancy without resubmission to the BBRS for its approval of the variation and of the unit which includes the variation. The State Enforcement Agencies, Local Enforcement Agencies or an inspection agency shall inspect the manufactured building, manufactured building component or manufactured home wherever it is located and such inspection may include such tests or destructive or nondestructive disassembly as the State Enforcement Agencies or an inspection agency deems necessary to assure compliance with the applicable Codes and 780 CMR 110.R3. Local Enforcement Agencies may be designated by the BBRS or State Enforcement Agencies as inspection agencies for such purposes.

780 CMR 110.R3.4 INSPECTION BY THE STATE ENFORCEMENT AGENCIES OR THEIR AGENTS

The State Enforcement Agencies shall make, or cause to be made, such inspections of the entire processing of manufacturing, certifying, handling, storing and transporting of manufactured buildings or manufactured building components produced pursuant to approved building systems as they deem necessary.

110.R3.4.1 Inspection of Facilities. As part of the process of evaluating building systems and compliance assurance programs, the State Enforcement Agencies shall inspect, or cause to be inspected, the manufacturing facilities in which the buildings or building components are to be manufactured.

110.R3.4.2 Inspection According to Compliance Assurance Programs. The State Enforcement Agencies or an inspection agency shall make such inspections as may be required by an approved compliance assurance program, or as may be deemed necessary by the State Enforcement Agencies.

110.R3.4.3 Inspection of Damaged Components. Prior to the issuance of a certificate of occupancy, the State Enforcement Agencies or an inspection agency shall inspect, or cause to be inspected, certified manufactured buildings or manufactured building components which it determines to have been sufficiently damaged after certification to warrant such inspection and to take such action with regard to such buildings or building components as is authorized hereof, or as is otherwise necessary to eliminate dangerous conditions. The local enforcement agencies may be designated by the BBRS or the State Enforcement Agencies as the inspection agency.

110.R3.4.3.1 Repairing Damaged Components. The State Enforcement Agencies or an inspection agency shall require manufactured buildings or manufactured building components which are so damaged as to no longer comply with the applicable Codes and 780 CMR 110.R3 to be repaired and made to comply within a reasonable time; or if they are so damaged that they cannot be brought into compliance, the State Enforcement Agencies or inspection agency shall order that the labels be removed voided for from such buildings, building components or manufactured homes. A report under 780 CMR 110.R3.4 shall be filed with the inspection agency, BBRS and State Enforcement Agency.

110.R3.4.3.2 Irreparably Damaged Components. Irreparably damaged buildings or building components shall be disposed of by the manufacturer.

110.R3.4.4 Monitoring Inspection Agency. The State Enforcement Agencies or their designated agents shall examine each approved inspection agency, at any reasonable time, and without prior announcement, in order to monitor the reliability of each agency and of its monitoring of each compliance assurance program. Each such examination shall investigate the adequacy of all procedures used by the agency in monitoring compliance assurance programs including inspection, tests, production methods, process controls, operator performance, materials, receipts, storage and handling, workmanship standards, records and all other activities which implement the compliance assurance program in the manufacturing facility, during transport, on-site, and at critical subcontractors' facilities. The results of such examinations shall be filed with the office of the BBRS. Copies of such reports shall be sent to the inspection agency and the State Enforcement Agencies. Inspection agencies shall be specifically notified by the BBRS of any deficiencies and of the manner and time by which such deficiencies must be eliminated. If deemed necessary by the State Enforcement Agencies, an inspection agency's approval may be suspended or revoked by the BBRS as provided.

110.R3.4.4.1 Prior to Approval. Such examinations may also be conducted before approving an inspection agency.

110.R3.4.5 Inspection by Disassembly. No inspection entailing disassembly, damage to or destruction of certified manufactured buildings, manufactured building components or manufactured homes shall be conducted except to implement 780 CMR 110.R3.

780 CMR 110.R3.5 LOCAL ENFORCEMENT AGENCY PROCEDURES AND INSPECTIONS

110.R3.5.1 Issuance of Building Permits. Upon application and in conformity with the provisions of 780 CMR, the building official shall issue building permits for installation of certified manufactured buildings, manufactured building components or manufactured housing.

110.R3.5.1.1 Licensed Construction

Supervisors and Certified Installers. A construction supervisor, duly licensed in accordance with 780 CMR 110.R5, shall, in accordance with the *Sixth Edition of the Massachusetts State Building Code*, 780 CMR 108.3.5, act as the agent for the owner for the purpose of applying for and obtaining any and all building permits required for the field erection of all one or two family manufactured dwellings subject to the provisions of 780 CMR and 780 CMR 110.R3 as applicable.

As part of the building permit application process, the licensed construction supervisor shall submit to the building official, in writing, the name of the installer, who shall be duly certified by the manufacturer to install said manufacturer's product, and is identified as a *certified installer of manufactured buildings* (certified installer) by said manufacturer. The certified installer shall be responsible for the safe and proper placement and connection of the manufactured home units in accordance with 780 CMR, 780 CMR 110.R3 and the specialized codes as listed in 780 CMR 100.00 under *CMR*.

The licensed construction supervisor shall be responsible for the construction of the foundation system, and all pertinent site work, in accordance with 780 CMR and 780 CMR 110.R3. The licensed construction supervisor shall provide at least 48 hours notice to the BBRS and the local building official before the placement and connection of such units shall begin. An application to local enforcement agencies for an appropriate permit shall, in addition to any other requirements, contain the following information.

110.R3.5.1.2 Permit Application–Statement of Content. A statement that the work to be performed under such permit is to include the installation of a certified manufactured building, manufactured building component or manufactured home in accordance with the provisions of the applicable codes, the statement is to be signed by the applicant or his agent, with the appropriate address.

110.R3.5.1.3 Permit Application – Building System. A true copy of the approved building system with respect to which the manufactured building or manufactured building component was manufactured or is to be manufactured, where one has not previously been furnished to that local enforcement agency.

110.R3.5.1.4 Permit Application – Building System Approval. A copy of the Building System Report, as approved by the BBRS, where it has not previously been furnished to the Local Enforcement Agency.

110.R3.5.2 Inspection of Site Preparation and Service Connections. Appropriate local enforcement agencies shall inspect site preparation work including foundations, not within the scope of the approval and certification, and the structural, mechanical, plumbing and electrical connections among units, for compliance with applicable law, rules and regulations.

110.R3.5.3 Compliance with Instructions. Appropriate local enforcement agencies shall inspect all manufactured buildings, manufactured building components or manufactured homes upon, or promptly after, installation at the building site to determine whether all instructions in the Building System Approval Report or conditions listed on the manufacturer's data plate have been followed.

This may include tests for tightness of plumbing and mechanical systems, and for malfunctions in the electrical system and a visual inspection for obvious nonconformity with the approved building system.

110.R3.5.3.1 Disassembly Prohibited. Unauthorized destructive disassembly of certified buildings and building components and mobile homes shall not be performed in order to conduct such tests or inspections, except as provided in 780 CMR 110.R3.3.4.3, nor shall there be imposed standards or test criteria different from those adopted by the State Enforcement Agencies or specified in the Building System Approval Report, or the "HUD's" Manufactured Home Construction and Safety Standards.

110.R3.5.3.2 Opening Panels. Nondestructive disassembly may be performed only to the extent of opening access panels and cover plates.

110.R3.5.4 Noncomplying New Units. Local enforcement agencies shall report to the BBRS in accordance with 780 CMR 110.R3.5.6 any non-complying manufactured buildings and building components.

110.R3.5.5 Certificates of Occupancy. Appropriate local inspectors shall issue certificates of occupancy for certified manufactured buildings and manufactured homes containing certified building components which otherwise comply with all the applicable codes, after they have been installed and inspected pursuant to the applicable codes and 780 CMR 110.R3, provided that any manufactured building or manufactured building component found not to comply with the Building System Approval Report or any manufactured home found not to comply with "HUD's" Manufactured Home Construction and Safety Standards shall be brought into compliance before such certificate of occupancy shall be issued.

110.R3.5.6 Reporting of violations to department of public safety. When any local enforcement agency is making an inspection and finds violations or suspected violations, it shall report the details of the violations in writing to the BBRS. Where violations are hazardous to occupants, a certificate of occupancy shall not be issued and the building shall not be occupied before such hazards are corrected.

If the violations are not hazardous, a temporary certificate of occupancy may be issued.

780 CMR 110.R3.6 FEES

110.R3.6.1 Deposit for Application to the BBRS. A deposit shall be required upon application to the BBRS to perform any of the functions in 780 CMR 110.R3.

110.R3.6.2 Establishment of Fees. Fees charged by the BBRS for functions performed shall be in accordance with the fee schedule established by the State Administrative Agencies as specified in 780 CMR 110.R3.18.

780 CMR 110.R3.7 NOTIFICATION OF CHANGES IN NAME, ADDRESS, OWNERSHIP OR LOCATION

110.R3.7.1 Notification by Manufacturers. Manufacturers shall notify the BBRS in writing within ten days of any of the following occurrences:

1. The corporate name is changed;
2. The main address of the company is changed;
3. There is a change in 25% or more of the ownership interest of the company within a 12-month period;
4. The location of any manufacturing facility is changed;
5. A new manufacturing facility is established; or
6. There are changes in principal officers of the firm.

The BBRS shall notify the State Administrative Agencies of such occurrences.

110.R3.7.2 Notification by Inspection Agencies. Inspection agencies shall notify the BBRS in writing within ten days of any of the following occurrences.

1. The company name is changed;
2. The main address of the company is changed;
3. There is a change in 25% or more of the ownership interest or control of the company within a 12-month period;
4. The location of any testing facility is changed;
5. A new testing facility is established; or
6. There are changes in principal officers and key supervisory and responsible personnel of the firm.

The BBRS shall notify the State Administrative Agencies of such occurrences.

780 CMR 110.R3.8 PROPRIETARY INFORMATION

All information relating to building systems and compliance assurance programs which the manufacturer or other party considers proprietary shall be so designated by him at the time of its submission, and shall be so held by the State Enforcement Agencies and State Administrative Agencies, except as the State Administrative Agencies determine in each case, that disclosure is necessary to carry out the purposes of the applicable codes and 780 CMR 110.R3.

PART II—REQUIREMENTS FOR SUBMISSION OF BUILDING SYSTEMS AND COMPLIANCE ASSURANCE PROGRAMS

780 CMR 110.R3.9 BUILDING SYSTEMS

Building systems shall meet the requirements set forth below to be evaluated for compliance with the standards, specifications and requirements adopted by the State Administrative Agencies.

110.R3.9.1 General Requirements.

110.R3.9.1.1 Plans, Specifications and Documentation. Building systems, including all plans, specifications and other documentation, shall be submitted in quadruplicate to the BBRS who shall act as the depository and disburser of all such items. The BBRS shall forward to the appropriate State Enforcement Agencies plans, specifications and documentation for their recommendations.

110.R3.9.1.2 Form and Fees. Building systems shall be submitted in the form prescribed by the BBRS and shall be accompanied by all required fees.

110.R3.9.1.3 Identification. All documents submitted with the application shall be identified to indicate the manufacturer's name, office address and address of the manufacturing facility.

110.R3.9.1.4 Plans Showing Elements. Plans shall be submitted showing all elements relating to specific systems on properly identifiable sheets.

110.R3.9.1.5 Application–Approved Architect or Engineer. Each building system application shall bear the signature and seal of an approved registered architect or registered professional engineer certifying that the building system complies with the applicable codes and standards promulgated herein.

110.R3.9.1.6 On-site Work Identified. All work to be performed on-site, including connection of all systems, equipment and appliances, shall be identified and distinguished from work to be performed in the manufacturing facility.

110.R3.9.1.7 Space for State Administrative Agencies Approval Stamp. A three inch × four inch blank rectangular space shall be provided on all sheets of plans near the title box for the BBRS's stamp of approval.

110.R3.9.1.8 Material Grade and Quality. Grade, quality and identification of all material shall be specified.

110.R3.9.1.9 Calculations and Test Reports. Design calculations and test reports shall be specified.

110.R3.9.1.9.1 Drawings to Scale. Drawings shall be drawn to scale and be legible.

110.R3.9.1.9.2 Label and Data Plate Location. Drawings shall indicate the location of the data plate.

110.R3.9.1.9.3 Drawings Dated and Identified. Drawings shall be dated and identified. The number of sheets in each set shall be indicated.

110.R3.9.2 Required Construction Details. Building systems for manufactured buildings shall provide or show, but not be limited to, the details listed below including the method of their testing or evaluation, or both. These requirements shall apply to the building systems for building components only to the extent deemed necessary by the State Enforcement Agencies to permit a proper evaluation of the building component.

110.R3.9.2.1 General.

1. Details and methods of installation of manufactured buildings or manufactured building components on foundations and/or to each other.
2. All exterior elevations.
3. Cross sections as necessary to identify major building components.
4. Details of flashing, such as at openings and at penetrations through roofs and subcomponent connections. Indicate flashing material and gauge to be used.
5. Attic access and attic ventilation.
6. Exterior wall, roof and soffit material as well as finish.
7. Interior wall and ceiling finish material.
8. Fire separation walls.
9. Sizes, locations and types of doors, windows and fire/smoke detectors.
10. Recommended foundation plans, vents and underfloor access.

110.R3.9.2.2 Building Classification.

1. Occupancy or use.
2. Area, height, and number of stories.
3. Type of construction.
4. Fireresistance ratings.

110.R3.9.2.3 Space and Fire Safety.

1. Details of fire resistance rated assemblies for all stairway enclosures, doors, walls, floors, ceilings, partitions, columns, roof and shaft enclosures.
2. Detail of Fire Protection Systems.
3. Details as to width of all aisles, exits, corridors, passageways and stairway enclosures.
4. Toxicity and flame spread classification of finished materials.

110.R3.9.2.4 Structural Detail Requirements.

1. Engineer's calculations of structural members, where appropriate.
2. Structural and framing details of all floors, roof and walls.
3. Details and stress diagrams of roof trusses.
4. Details of reinforcing steel.
5. Complete loading schedule.
6. Column loads and column schedule.
7. Lintel schedule.
8. Size, spacing and details of all structural elements.
9. Grade or quality of all structural elements (lumber, steel, etc.).
10. Elevation of structural elements, walls or sections thereof, providing resistance to vertical loads or lateral forces.
11. Complete details of all structural connections.

110.R3.9.2.5 Mechanical Detail Requirements.

1. Location of all equipment and appliances. Indicate equipment and appliances listed or labeled by approved agencies.
2. Heat loss and heat gain calculations.
3. Manufacturer's name, make, model, number, BTU, input and output rating of all equipment and appliances, as appropriate, or the equal thereof.
4. Duct and register locations, sizes, and materials.
5. Clearances from combustible material or surfaces for all ducts, flues and chimneys.
6. Method of providing required combustion air and return air.
7. Location of flues, vents and chimneys and clearances from air intakes and other vents and flues.
8. Details regarding dampers in ducts penetrating fire separations.
9. Complete drawings of fire sprinkler system, standpipe system or smoke/fire alarm system as required.
10. Detail of elevator or escalator system, including method of emergency operation.
11. Duct and piping insulation thickness.
12. Ventilation air calculations.

110.R3.9.2.6 Plumbing Detail Requirements.

1. Plan or schematic drawing of the plumbing layout, including but not limited to, size of piping, fitting, traps and vents, cleanouts and valves, gas, water, and drainage system.
2. Plumbing materials, and location of all equipment and appliances to be used. Indicate fixture unit capacity of system(s) and the make, model, and rating/capacity of equipment and appliances. Indicate equipment and appliances listed or labeled by approved agencies.
3. Make and model of safety controls (such as for water heaters), their location, and whether listed or labeled by approved agencies.
4. How piping is to be supported and intervals of support.

5. Location of vents above roofs and required clearances, including but not limited to clearances from air intakes, other vents and flues.
6. Methods of testing.

110.R3.9.2.7 Electrical Detail Requirements.

1. Plan of service equipment, including service entrance, conductors, service raceway and clearances above ground and above structures.
2. Method and detail for grounding service equipment.
3. Single line diagram of the entire electrical installation.
4. Load calculations for service and feeders.
5. Sizes of all feeders and branch circuits.
6. Size, rating and location of main disconnect/overcurrent protective devices.
7. Method of interconnection between manufactured buildings or manufactured building components and location of connections.
8. Location of all outlets and junction boxes.
9. i. Method of mounting fixtures and wiring installations.
10. Lighting power calculations.

780 CMR 110.R3.10 COMPLIANCE ASSURANCE PROGRAMS FOR MANUFACTURED BUILDINGS AND MANUFACTURED BUILDING COMPONENTS

Compliance assurance programs shall be approved if they meet the requirements set forth in 780 CMR 110.R3.10. It is the manufacturer's responsibility to execute every aspect of this program. The manufacturer shall continue to be responsible for all corrective actions required and the contractual relationship between the manufacturer and the inspection agency shall not diminish such responsibility. The manufacturer shall cooperate with the inspection agency by providing the inspection agency with all necessary reports, information, documents, records, facilities, equipment, samples and other assistance for assuring compliance.

The manufacturer's compliance assurance program shall be submitted to the BBRS in the form of a compliance assurance manual which shall contain complete documentation of all compliance assurance activities of both the manufacturer and the inspection agency. The manual shall be comprehensively indexed, and shall treat the material listed here in detail, as follows.

110.R3.10.1 Organization Requirements.

1. A procedure for periodic revision of the manual;
2. An organizational structure for implementing and maintaining the compliance assurance program and its functional relationship to other elements of the organization structure of the manufacturer, which structure shall provide for independence from the production department; Company officers and employees in charge of the compliance assurances program must be identified, and their training and qualifications specified;
3. A uniform system of audit (in-depth analysis of program effectiveness and means to identify deficiencies) to monitor program performance periodically;
4. Complete and reliable records of manufacturing and site operations, if any (suitable means of storage, preservation and accessibility of copies of forms to be utilized shall be included);
5. A system to control changes in production or inspection procedures;
6. A system to assure that working drawings and specifications, working instructions and standards, procurement documents, etc. conform to the approved building system;
7. A serial number system for buildings or building components; and
8. The method of safekeeping, handling and attaching labels and identification of those employees responsible therefor.

110.R3.10.2 Materials Control.

1. Procedure to assure effective control over procurement sources to ensure that materials, supplies and other items used in production and site operations, if any, conform to the approved plans, specifications and quality requirements;
2. Procedures for inspection of materials, supplies and other items at the point of receipt;
3. Method of protection of materials, supplies and other items against deterioration prior to their incorporation in the certified buildings or building component; and
4. Provision for disposal of rejected materials, supplies and other items.

110.R3.10.3 Production Control.

1. Procedures for timely remedial and preventive measures to assure product quality;
2. Provision, maintenance and use of testing and inspection;
3. Provision for frequency of sampling inspections;
4. Provision of necessary authority to reject defective work and carry out compliance assurance functions, notwithstanding any conflict with production department goals and needs;
5. A schematic of the manufacturing operation showing the location of inspection stations, and "hold" points for mandatory inspection characteristics;
6. Inspection and test procedures, including accept/reject criteria and mandatory inspection characteristics;

7. Standards of workmanship; and
8. Provision of disposal of rejects.

110.R3.10.4 Finished Product Control.

1. Procedure for final inspection of all manufactured buildings or manufactured building components before shipment to the site or storage point, including identification and labeling handling;
2. Procedures for handling and storing all finished manufactured buildings or manufactured building components, both at the manufacturing plant or other storage point and after delivery to the building site;
3. Procedures for packing, packaging and shipping operations and related inspections; and
4. Procedures for transportation, including all measures to protect against damage while in transit, and setting forth the modes of transportation to be utilized and the carrying equipment and procedures.

110.R3.10.5 Installation Control.

1. Installation procedures including component placement, equipment and procedures, field erection and finishing work, utility connection instructions and all appropriate on-site inspection criteria and test descriptions; and
2. Organizational provisions for field repair and disposal of rejects.

110.R3.10.6 Permission for Inspection. The manufacturer shall provide the BBRS with written permission, signed and notarized, for the State Enforcement Agencies to inspect his manufacturing facilities, his products, and building sites under his control at any reasonable time without prior announcement.

110.R3.10.7 Inspections by the State Enforcement Agencies. The Compliance Assurance Manual shall contain detailed plans for inspections by the State Enforcement Agencies or inspection agency.

PART III—APPROVAL OF INSPECTION AGENCIES

780 CMR 110.R3.11 REQUIREMENTS FOR SUBMISSION

An inspection agency seeking approval shall submit a quadruplicate application to the BBRS which shall include the items listed in 780 CMR 110.R3.1 1.

110.R3.11.1 Articles of Incorporation. The original Articles of Incorporation of the agency and all subsequent amendments thereto, as filed in the State of Incorporation.

110.R3.11.2 Bylaws. The bylaws of the organization, if any.

110.R3.11.3 Business Affiliations of Members. The names, addresses and business affiliations of all members of the Board of Directors and of top management personnel.

110.R3.11.4 Stock. Individual interests representing more than 10% of the outstanding ownership reflecting the financial interest of the agency's Board of Directors and top management personnel.

110.R3.11.5 Certifications. Certification by the agency that.

1. Its Board of Directors, as a body, and its technical personnel, as individuals, can exercise independence of judgment; and
2. Its activities pursuant hereto will result in no financial benefit to the agency via stock ownership, or other financial interests in any producer, supplier or vendor of products involved, other than through standard published fees for services rendered.

110.R3.11.6 Experience of Directors. Names, years of experience, state in which professionally registered and other qualifications of the directors of inspection or evaluation programs.

110.R3.11.7 Experience of Employees. Names and years of experience of employees practicing in the following disciplines. architecture, structural engineering, mechanical engineering, electrical engineering, fire protection and other branches of engineering; the state in which each is registered and the service each performs.

110.R3.11.8 Organization Chart. An organization chart showing management and supervisory persons including the number of graduate engineers and architects, and the names of all consulting engineers or architects, designating which are full-time and which are part-time employees.

110.R3.11.9 Number and Location of Personnel. Number and location of factory inspectors, supervisors, and other technicians, including evaluators of factory inspectors and the qualifications of each specialized group, including records of work experience, licenses held and other pertinent qualifications; description of types of work each group and each technician is expected to perform and the qualifications of each group and each technician to perform the work assigned.

110.R3.11.10 Employees Training Programs. An outline of the training program, if any, of the agency to assure that all inspectors, evaluators and other technicians are properly trained to do each job assigned to them.

110.R3.11.11 Employee Supervision. An outline of the general procedures for supervision of inspectors and evaluators, including checking and evaluation of their work.

110.R3.11.12 Non-employees Relationships. All engineers, technicians and other personnel who will perform services for the organization but who are not employees of the organization, and the supervisory and other relationships which each will have to the agency.

110.R3.11.13 Products Evaluated. Type of products, components, equipment, structures and other items which the organization has evaluated, tested or inspected and the number of years of experience the organization has had with each, and the type of codes, standards, specifications and requirements with respect to which the organization has had experience in providing evaluation, inspection or testing services, and the number of years experience with each.

110.R3.11.14 Frequency Capability. Description of the frequency with which the agency is capable of performing inspections or evaluations.

110.R3.11.15 State approved in. List of the states in which the agency is now approved to inspect or evaluate manufactured buildings or manufactured building components or parts thereof for compliance with approved building systems.

780 CMR 110.R3.12 PROCEDURES FOR APPROVING INSPECTION AGENCIES

110.R3.12.1 Qualifications. Upon the recommendation of the State Enforcement Agencies, the BBRS may approve inspection agencies which meet the requirements of the applicable codes and 780 CMR 110.R3.0 and which the State Administrative Agencies find otherwise qualified to perform the functions proposed to be delegated to them.

110.R3.12.2 Suitability of Application. Prior to a full evaluation of an application for approval, the BBRS shall determine whether such application is unsuitable for processing. In the event the application is found to be suitable for processing, the applicant shall be notified in writing of such unsuitability and the basis thereof within 30 days of the date of the application is received by the BBRS. In such event, all but $25.00 of the fee will be returned, and the rulings of unsuitability shall be without prejudice. Any subsequent submission shall be treated as a new application.

110.R3.12.3 Approvals. In the event of approval of the BBRS, an inspection agency shall be notified by a letter from the BBRS indicating such approval and stating specifically the functions which the applicant has been approved to perform. Such approval shall not constitute the actual delegation of such functions.

780 CMR 110.R3.13 SUSPENSION AND REVOCATION

110.R3.13.1 Grounds. The BBRS may suspend or revoke its approval of any inspection agency if the approval was issued in error; was issued on the basis of incorrect information; was issued in violation of any of the applicable Codes or 780 CMR 110.R3; if the inspection agency violates any of the applicable Codes or 780 CMR 110.R3, if examination discloses that the agency failed to perform properly; or for such other cause as may be deemed sufficient by the State Enforcement Agencies to warrant such action.

110.R3.13.2 Procedures.

110.R3.13.2.1 General. If the BBRS suspends or revokes the approval of an inspection agency, the inspection agency shall be given notice in writing from the BBRS of the suspension or revocation with the reasons therefore set forth therein. Manufacturers being evaluated or inspected by such agencies, all local enforcement agencies within this State, and the State Enforcement Agencies shall also be notified in writing of such suspension or revocation. Such notices shall contain instructions to the manufacturer and to the local enforcement agency as to the procedures to be followed regarding manufactured buildings or manufactured building components previously certified by an agency whose approval has been suspended or revoked.

110.R3.13.2.2 Records. An inspection agency whose approval has been suspended or revoked shall within 90 days of the suspension or revocation deliver to the custody of the BBRS the originals of all records required to be maintained during the course of the inspection agency's operations pursuant to the applicable codes and 780 CMR 110.R3.0.

110.R3.13.2.3 Labels. An inspection agency for which approval has been suspended or revoked shall within 90 days of the suspension or revocation deliver to the custody of the BBRS all labels in the agency's possession, under its control, or for which it is responsible pursuant to the applicable codes and 780 CMR 110.3.0.

PART IV—APPEALS

780 CMR 110.R3.14 HEARINGS

All hearings shall comply with applicable sections of the applicable codes and the Rules and Regulations thereof established for the purpose of appeal.

PART V—SCHEDULE OF FEES

780 CMR 110.R3.15 ESTABLISHMENT

The following is the SCHEDULE OF FEES established by the BBRS for certifying manufactured buildings or manufactured building components. Fees shall be made payable to the "Commonwealth of Massachusetts Board of Building Regulations and Standards" and shall accompany all applications for certification.

110.R3.15.1 Compliance Assurance Programs and Building Systems. An initial fee of$1 ,200.00

shall be charged each manufacturer for its certified compliance assurance program for each plant desiring certification. The maximum fee charged under 780 CMR 110.R3. 15 shall be $1,200.00 for each manufacturing plant.

110.R3.15.2 Third Party Inspection Agencies. An initial fee of $500.00 shall be charged to each third party inspection agency.

110.R3.15.3 Annual Renewal Fees.

1. One year from the date of certification of the manufacturer and every year thereafter certification is in effect, there shall be paid an annual renewal fee of $650.00 for each such certification.
2. One year from the date of certification of the Third Party Inspection Agency, and every year thereafter certification is in effect, there shall be paid an annual renewal fee of $500.00.

110.R3.15.4 Labels.

1. A fee of $50.00 per unit of a manufactured building shall be charged for each label issued by the BBRS.

   Note: A "unit" as used in 780 CMR 110.R3.15 shall mean any building or proportion thereof which is towed or shipped separately to be tied together at the site.
2. A fee of $10.00 per building component shall be charged for each label issued by the BBRS for building components.
3. Lost or damaged Labels Upon satisfactory proof to the BBRS of lost or stolen labels, not the result of negligence, labels may be replaced at a cost of $2.00 each.

110.R3.15.5 Other Fees. The BBRS reserves the right to charge other fees based on scope of services necessary to be performed.

NON-TEXT PAGE

780 CMR 110.R4

LICENSING NATIVE LUMBER PRODUCERS

(Note: *780 CMR 110.R4 is unique to Massachusetts*)

780 CMR 110.R4.1 ADMINISTRATION

110.R4.1.1 Scope. The provisions of 780 CMR 110.R4 shall govern the licensing of native lumber producers.

110.R4.1.2 Definitions. The following words and terms shall, for the purposes of 780 CMR 110.R4 and as used elsewhere in 780 CMR, have the meaning indicated in 780 CMR 110.R4.1.2.

BBRS. State Board of Building Regulations and Standards.

NATIVE LUMBER. Native lumber is wood processed in the Commonwealth of Massachusetts by a mill registered in accordance with the regulations of the BBRS. Such wood is ungraded but is stamped or certified in accordance with the requirements of the *Sixth Edition of the Massachusetts State Building Code*, 780 CMR 2303.1.1. For the purpose this definition, native lumber shall be restricted to use in one-and two-story dwellings, barns, sheds, agricultural and accessary buildings and structures and other uses as permitted by 780 CMR 23.00.

NATIVE LUMBER PRODUCERS. Persons or corporations in the business of milling wood into native lumber within the Commonwealth of Massachusetts.

PERSON. Individual, partnership, corporation, trust, joint venture, etc.

110.R4.1.3 Registration. No person shall engage in the producing of native lumber for use in buildings or structures within the Commonwealth of Massachusetts unless registered by the BBRS.

110.R4.1.4 Application for Registration. Each person desiring registration as producer of native lumber shall apply and furnish evidence satisfactory to the BBRS that he is qualified to be registered in accordance with 780 CMR 110.R4. Qualification requirements shall be provided by the BBRS with the application form.

110.R4.1.5 Registration Fee. Applications shall be accompanied by a registration fee of $50.00. This initial registration shall be valid for two years.

110.R4.1.6 Renewals. Registration shall be renewed every tow years. Within 30 days before the expiration date of any such registration, the BBRS shall forward to each person an application form for renewal. Upon receipt of the completed form and fee, BBRS shall renew the registration for a period of two years or notify the applicant of reasons for refusal. *Any application for renewal of registration which has expired shall require the payment of a new registration fee.*

110.R4.1.7 Prequalifying Agent. State Inspectors of the Department of Public Safety shall act as agents of the BBRS to inspect native lumber producing facilities. Upon receipt of a completed application, the State Inspector shall inspect the facility for compliance with the required qualifications and make recommendation to the BBRS.

110.R4.1.8 Penalties. Any person who fails to comply with the requirements of 780 CMR 110.R4 or who falsifies an application shall be subject to the penalties and actions as prescribed in 780 CMR 118.0.

780 CMR 110.R4. 2 REGISTRATION STAMP

110.R4.2.1 Stamp. Each person registered by the BBRS shall be issued a specific name and number for use in stamping or certifying the native lumber which he produces.

110.R4.2.2 Stamp Contents. Each stamp shall be a minimum of two inches by four inches with a minimum of 36 pt. letters and shall contain the following information.

1. Name of native lumber producer;
2. Registration number; and
3. Species of wood.

110.R4.2.3 Stamp Use. Each piece of native lumber produced shall bear the producer's stamp.

110.R4.2.4 Stamp – Unlawful Use. It shall be unlawful to use a stamp registered for a specific mill at any other mill.

110.R4.2.5 Stamp – Manufacture. Each producer shall be responsible for obtaining stamps made for their use in accordance with the requirements of the BBRS and 780 CMR 110.R4.

780 CMR 110.R4.3 REVOCATION AND SUSPENSION PROCEDURES

110.R4.3.1 Revocation and Suspension. The BBRS on its own initiative or upon the recommendation of the State Inspector may suspend or revoke the registration of any such mill registered in accordance with 780 CMR 110.R4, 780 CMR or the standards of good practice. Notice of suspension or revocation of such registration shall be in writing with the reasons for suspension or revocation clearly set forth, and served in accordance with 780 CMR 118.6.

110.R4.3.2 Notice and Conference. Prior to suspension or revocation of the registration of any such mill so registered, written notice of such intent shall be served by the State Inspector in accordance with 780 CMR 118.6. Within ten calendar days of receipt of such notice, the affected mill may request a conference with the State Inspector who will hear facts and make their recommendations to the BBRS.

110.R4.3.3 Effect of. Upon suspension or revocation of the registration of any such mill so registered, such mill shall immediately cease engaging in the stamping or certifying of native lumber. The filing of an appeal with the State Building Code Appeals Board shall stay such suspension or revocation subject to 780 CMR 122.3.2.

780 CMR 110.R4.4 APPEALS

110.R4.4.1 Building Code Appeals Board. Anyone aggrieved by the decision of the BBRS, or others may appeal to the State Building Code Appeals Board in accordance with 780 CMR 122.0.

780 CMR 110.R5

CONSTRUCTION SUPERVISORS

(Note: This Regulation is unique to Massachusetts)

780 CMR 110.R5 covers the licensing rules and regulations for construction supervisors as defined in 780 CMR. 780 CMR 110.R5 shall become in full force and effect on January 1, 2007.

780 CMR 110.R5.1 GENERAL

110.R5.1.1 Authority. As authorized by M.G.L. c. 143, § 94(g) and (i), the BBRS establishes the rules and regulations for Licensing Construction Supervisors.

110.R5.1.2 Definitions. Unless otherwise expressly stated in 780 CMR the following terms shall, for the purpose of 780 CMR 110.R5, have the meaning indicated in 780 CMR 110.R5.1.2.

BBRS. State Board of Building Regulations and Standards.

CONSTRUCTION SUPERVISOR. A person of good moral character who is deemed qualified by the BBRS and has acquired a license by methods herein prescribed in one or more of the following categories:

CATEGORIES OF LICENSE.

1. **Unrestricted Construction Supervisor License (UCSL)**. An Unrestricted Construction Supervisor License allows an individual to directly supervise persons engaged in the construction, reconstruction, alteration, repair, removal or demolition involving any activity regulated by 780 CMR in respect to the following types of buildings and structures. (Such term shall also apply to persons supervising themselves.)

   (a) Buildings of any use group as defined by 780 CMR 51.00 through 99.00 which contain less than 35,000 cubic feet (991 m^3) of enclosed space;

   (b) One- and two-family dwelling buildings or any accessory building thereto, irrespective of size;

   (c) Buildings used for farm purposes;

   (d) Retaining walls less than ten feet (3048 mm) in height at all points along the wall as measured from the base of the footing to the top of the wall.

2. **Restricted Construction Supervisor License (RCSL)**. An Restricted Construction Supervisor License allows an individual to directly supervise persons engaged in the construction, reconstruction, alteration, repair, removal or demolition involving any activity regulated by 780 CMR in respect to one- and two-family dwelling buildings and any accessory building thereto, irrespective of size. (Such term shall also apply to persons supervising themselves.)

   A licensed construction supervisor possessing at least a restricted category license shall be required for the installation of all manufactured one and two family homes as required by 780 CMR 51.00 through 99.00 and 780 CMR 110.R3, as applicable.

3. **Masonry Only Construction Supervisor License (MCSL)**. A Masonry Only Construction Supervisor License allows an individual to directly supervise persons engaged in the construction, reconstruction, alteration, repair, removal or demolition involving the elements of fireplaces, chimneys, required means of egress stairs made of masonry, masonry retaining walls deemed to be a threat to public safety, health or welfare and that retain four feet or more of unbalanced fill, and other masonry structures for which a building permit is required, so long as such is not governed by construction control provisions of the Massachusetts Basic Building Code. Such term shall also apply to persons supervising themselves. (A masonry only license is not sufficient for the construction of masonry buildings. Supervision of such work would require possession of at least a restricted license, dependent upon the scope of work.)

4. **Residential Roof Covering Construction Supervisor License (RCCSL)**. A Residential Roof Covering Construction Supervisor License allows an individual to directly supervise persons engaged in the installation, alteration, repair or removal of residential roof coverings as defined by 780 CMR 51.00 through 99.00. Such term shall also apply to persons supervising themselves. (A Residential Roof Covering License does not allow the licensee to work on or supervisor work relating to the structural elements of a residential roof, including sheathing. Such work would require possession of at least a restricted license, dependent upon the scope of work.)

5. **Residential Window and Siding (Exterior Weather Protection) Construction Supervisor License (WSCSL)**. A Residential Window and Siding (Exterior Weather Protection) Construction Supervisor License allows an individual to directly supervise persons engaged in the installation, alteration, repair or removal of residential windows and siding as defined by this code. Such term shall also apply to persons supervising themselves. (A Residential Window and Siding License does not allow the licensee to work on or supervisor work relating to the structural

elements of a residential building, including sheathing. Such work would require possession of at least a restricted license, dependent upon the scope of work.)

6. **Residential Solid Fuel-Burning Appliance Installer Construction Supervisor License (SFCSL).** A Residential Solid Fuel-Burning Appliance Installers License allows an individual to directly supervise persons engaged in the installation, alteration, repair or removal of residential solid fuel-burning appliances by 780 CMR 51.00 through 99.00. Such term shall also apply to persons supervising themselves. (A Residential Solid Fuel-burning Appliance Installer Construction Supervisor License does not allow the licensee to work on or supervisor work relating to any structural elements of a residential building, including sheathing. Such work would require possession of at least a restricted license, dependent upon the scope of work.)

7. **Demolition Only Construction Supervisor License (DCSL).** A Demolition Only Construction Supervisor License allows an individual to directly supervise persons engaged in the demolition or removal of single- and two-family residential building and accessory structures. Such term shall also apply to persons supervising themselves. (A Demolition Only Construction Supervisor License does not allow the licensee to work on or supervisor construction, reconstruction alteration or repair work relating to residential buildings. Such work would require possession of at least a restricted license, dependent upon the scope of work.)

HEARINGS OFFICER. The Hearings Officer is the person selected by the BBRS to carry out the disposition of complaints against licensed construction supervisors or other individuals or entities licensed, registered or certified under the provisions of 780 CMR.

LICENSED DESIGNEE. Any individual designated by the license holder to be present, in the absence of said license holder, during any of the periods stated in 780 CMR 110.R5.2.12. Such designee shall also hold a Construction Supervisor's License in the appropriate category (or better), but his name or license number need not be contained on the building permit application.

RECOGNITION. The approval by the BBRS of an application and related documents by one desirous of being licensed as a construction supervisor.

110.R5.1.3 Scope.

1. 780 CMR 110.R5 shall govern the testing and licensing of individuals who are found to possess the requisite qualifications to be licensed as a construction supervisor and to have charge or control of construction, reconstruction, alteration, repair, removal or demolition of certain buildings or structures or parts thereof, as identified.

2. Except for those structures governed by Construction Control as regulated by the *Seventh Edition of the Massachusetts State Building Code*, 780 CMR 116.0 (the *Massachusetts Basic Building Code* for buildings other than one-and two-family dwellings), any individual directly supervising persons engaged in construction, reconstruction, alteration, repair, removal or demolition involving activities regulated by 780 CMR shall be licensed in an appropriate category according to 780 CMR 110.R5.2.

110.R5.1.4 Administration and Enforcement. The BBRS shall administer and enforce the provisions of 780 CMR 110.R5. The BBRS or those designated by it shall administer examinations, under 780 CMR 110.R5, of persons desirous of being registered as qualified to receive a license as a construction supervisor.

110.R5.1.5 Hearings Officer. The BBRS shall appoint a Hearings Officer or Hearings Officers and who shall serve at the pleasure of the Board. Hearings Officer(s) shall conduct hearings on behalf of the Board relative to complaints filed against CSL holders and shall issue corresponding decisions.

780 CMR 110.R5.2 REGISTRATION AND LICENSING

110.R5.2.1 Qualifications. Each applicant for license must prove to the Board that he or she possesses at least the minimum qualifications identified below for the category of license sought. Members of the Board of Building Regulations and Standards (BBRS) may consider other acceptable evidence if an applicant, for reasons beyond his or her control, is not able to provide letters of attestation as described.

1. **Unrestricted Construction Supervisor License (UCSL).** An Unrestricted Construction Supervisor License candidate shall demonstrate that he or she has had at least three years of experience in building construction or design under the supervision of an individual possessing an unrestricted construction supervisors license or a registered professional engineer or architect. Acceptable evidence in demonstration of this requirement shall be in the form of a letter of attestation by the licensed construction supervisor or registered professional engineer or architect indicating that the candidate possesses such minimum qualification and identifying specific projects (spanning a period of at least three years) in which the candidate was involved. Said letter shall be made part of the application to examine as described in 780 CMR 110.R5.2.6.

Successful completion of a three or four year vocational high school or other vocational school program in the field of building construction shall be deemed as satisfying one year of the required three years experience as cited 780 CMR 110.R5.2.1. (The BBRS shall determine when vocational training other than in building construction, satisfies a portion of the three year experience criteria.)

2. **Restricted Construction Supervisor License (RCSL).** A Restricted Construction Supervisor License candidate shall demonstrate that he or she has had at least three years of experience in the construction or design of single- or two-family dwelling buildings under the supervision of an individual possessing an restricted construction supervisors license, a registered professional engineer or architect or a home designer. Acceptable evidence in demonstration of this requirement shall be in the form of a letter of attestation by the licensed construction supervisor, registered professional engineer or architect or home designer indicating that the candidate possesses such minimum qualification and identifying specific projects (spanning a period of at least three years) in which the candidate was involved. Said letter shall be made part of the application to examine as described in 780 CMR 110.R5.2.6.

Successful completion of a three or four year vocational high school or other vocational school program in the field of building construction shall be deemed as satisfying one year of the required three years experience as cited 780 CMR 110.R5.2.1. (The BBRS shall determine when vocational training other than in building construction, satisfies a portion of the three year experience criteria.)

3. **Residential Roof Covering Construction Supervisor License (RCCSL).** A Residential Roof Covering Construction Supervisor License candidate shall demonstrate that he or she has had at least three years of experience in the installation, alteration, repair or removal of residential roof coverings as defined by 780 CMR 51.00 through 99.00. Acceptable evidence in demonstration of this requirement shall be as identified on the application to examine as described in 780 CMR 110.R5.2.6.

Candidates for this license who can demonstrate to the satisfaction of the Board that they have had at least five years experience in the supervision of individuals engaged in the installation, alteration, repair or removal of residential roof coverings as defined by this code shall receive a license in this category without being required to examine. Said experience shall be within the period spanning January 1990 to January 2008. Acceptable evidence in demonstration of this requirement shall be in the form of a letter of attestation by the candidate indicating that he or she possesses such minimum qualification and identifying specific projects (spanning a period of at least a five years during the noted time frame) in which the candidate was involved with residential roof projects, noting the name of the owner and address of said projects. Said letter shall be made part of the application to examine as described in 780 CMR 110.R5.2.6.

The Board shall establish a date–certain when this license is required.

4. **Residential Window and Siding (Weather Protection) Construction Supervisor License (WSCSL).** A Residential Window and Siding Construction Supervisor License candidate shall demonstrate that he or she has had at least three years of experience in the installation, alteration, repair or removal of residential windows and/or siding as defined by 780 CMR 51.00 through 99.00. Acceptable evidence in demonstration of this requirement shall be as identified on the application to examine as described in 780 CMR 110.R5.2.6.

Candidates for this license who can demonstrate to the satisfaction of the Board that they have had at least five years experience in the supervision of individuals engaged in the installation, alteration, repair, or removal of residential widows and/or siding as defined by this code shall receive a license in this category without being required to examine. Said experience shall be within the period spanning January 1990 to January 2008. Acceptable evidence in demonstration of this requirement shall be in the form of a letter of attestation by the candidate indicating that he or she possesses such minimum qualification and identifying specific projects (spanning a period of at least a five years during the noted time frame) in which the candidate was involved with residential window and siding projects, noting the name of the owner and address of said projects. Said letter shall be made part of the application to examine as described in 780 CMR 110.R5.2.6.

5. **Residential Solid Fuel-Burning Appliance Installer Construction Supervisor License (SFCSL).** A Residential Solid Fuel-Burning Appliance Installer Construction Supervisor License candidate shall demonstrate that he or she has had at least three years of experience in the installation, alteration, repair or removal of residential solid fuel-burning appliances as defined by 780 CMR 51.00 through 99.00. Acceptable evidence in demonstration of this requirement shall be as identified on the application to examine as described in 780 CMR 110.R5.2.6 together with any technical knowledge the Board may require him or her to possess.

Candidates for this license who can demonstrate to the satisfaction of the Board that they have had at least five years experience in the supervision of individuals engaged in the installation, alteration, repair or removal of residential solid fuel-burning appliances as defined by this code shall receive a license in this category without being required to examine. Said experience shall be within the period spanning January 1990 to January 2008. Acceptable evidence in demonstration of this requirement shall be in the form of a letter of attestation by the candidate indicating that he or she possesses such minimum qualification and identifying specific projects (spanning a period of at least a five years during the noted time frame) in which the candidate was involved in residential solid fuel-burning projects, noting the name of the owner and address of said projects. Said letter shall be made part of the application to examine as described in 780 CMR 110.R5.2.6.

The Board shall establish a date–certain when this license is required.

6. **Demolition Only Construction Supervisor License (DCSL)**. A Demolition Only Construction Supervisor License candidate shall demonstrate that he or she has had at least three years of experience in the demolition or removal of single- and two-family dwelling buildings and accessory structures as defined by this code. Acceptable evidence in demonstration of this requirement shall be as identified on the application to examine as described in 780 CMR 110.R5.2.6.

Candidates for this license who can demonstrate to the satisfaction of the Board that they have had at least five years experience in the supervision of individuals engaged in the demolition or removal of single- and two-family dwelling buildings and accessory structures as defined by 780 CMR 51.00 through 99.00 shall receive a license in this category without being required to examine. Said experience shall be within the period spanning January 1990 to January 2008. Acceptable evidence in demonstration of this requirement shall be in the form of a letter of attestation by the candidate indicating that he or she possesses such minimum qualification and identifying specific projects (spanning a period of at least five years during the noted time frame) in which the candidate was involved with the demolition or removal of single- and two-family dwelling buildings and accessory structures, noting the name of the owner and address of said projects. Said letter shall be made part of the application to examine as described in 780 CMR 110.R5.2.6.

The Board shall establish a date–certain when this license is required.

7. **Masonry Only Construction Supervisor License (MCSL)** A Masonry Only Construction Superivisor License candidate shall demonstrate that he/she has had at least three years of experience in the construction, reconstruction, alteration, repair, removal or demolition involving the elements of fireplaces, chimneys, required means of egress stairs made of masonry, masonry retaining walls deemed to be a threat to public safety, health or welfare and that retain four feet or more of unbalanced fill, and other masonry structures for which a building permit is required. Acceptable evidence in demonstration of this requirement shall be as identified on the application to examine as described in 780 CMR 110.R5.2.6.

Candidates for this license who can demonstrate to the satisfaction of the Board that they have had at least five years experience in the supervision of individuals engaged in the construction, reconstruction, alteration, repair, removal or demolition involving the elements of fireplaces, chimneys, required means of egress stairs made of masonry, masonry retaining walls deemed to be a threat to public safety, health or welfare and that retain four feet or more of unbalanced fill, and other masonry structures for which a building permit is required as defined by this code shall receive a license in this category without being required to examine. Said experience shall be within the period spanning January 1990 to January 2008. Acceptable evidence in demonstration of this requirement shall be in the form of a letter of attestation by the candidate indicating that he/she possesses such minimum qualification and identifying specific projects (spanning a period of at least five years during the noted time frame) in which the candidate was involved with masonry projects, noting the name of the owner and address of said projects. Said letter shall be made part of the application to examine as described in Section 110.R5.2.6.

110.R5.2.2 Examinations. Examinations shall be held only by appointment. All applications must be filed in accordance with the Massachusetts Construction Supervisor (MACS) Candidate Bulletin of Information.

110.R5.2.3 License Approval. A majority vote of the members of the Board shall be required to grant a license.

110.R5.2.4 Expiration. Licenses issued pursuant to these rules and regulations shall expire three years from the date of issuance which shall be noted on said license and may be renewed.

A renewal of an original license shall be for periods of two years and a renewal license shall expire two years from the date of issuance which shall be noted on said license and may be renewed.

A renewal license shall not be issued unless application therefore is made within one year of the date of expiration of the most recently issued license. Failure to submit a renewal application and to acquire a license within this time period shall be cause for examination or reexamination.

110.R5.2.5 Fees. See 780 CMR 110.R5.3.5.

110.R5.2.5.1 Building Official Fees. The BBRS shall grant a license at no fee to any building official who, as a condition of his employment requires such license; provided that such person meets the necessary qualifications for licensure and provided further, that such license shall be authorized for use only during the course of employment and shall be appropriately stamped to indicate as such.

110.R5.2.6 Procedure for Obtaining a License.

110.R5.2.6.1 Application. Applications shall be submitted on forms supplied by the BBRS or its authorized agent.

110.R5.2.6.2 Forms. The applicable forms may be mailed to the appropriate testing agency as detailed in the Massachusetts Candidates Bulletin (MACS). It shall be the responsibility of the applicant to assure that the required forms are received by the testing agency. All forms shall be accompanied by the required license fee.

110.R5.2.6.3 Records. The BBRS shall keep a copy of the application and a computer file listing all licensed construction supervisors.

110.R5.2.6.4 Notification of Examination Date. Upon receipt of a fully completed application, an examination date shall be set and the applicant so notified.

110.R5.2.7 False Statements. Any false statement on the application or references shall be sufficient reason to refuse to issue a license, or to suspend or revoke a license if issued.

110.R5.2.8 Cause for Reprimand, Suspension or Revocation. The following shall be grounds for reprimand, suspension or revocation of a license:

(1) the applicant made a false statement on their application for licensure;

(2) a licensee made a false statement to the Board;

(3) any violation of 780 CMR;

(4) work was performed without a building permit in violation of 780 CMR 11.0 and 5111.0;

(5) failure to fully cooperate with a Board investigation into a complaint;

(6) failure to turn over a suspended or revoked license to the Board

(7) failure to abide by a mandate or order of the Board

(8) failure to properly supervise a project or be present at a work site as required by 780 CMR 110.R5.2.15.2.

110.R5.2.9 Procedure for Suspension and/or Revocation of License.

110.R5.2.9.1 Complaints. All complaints relative to a licensee must be in writing on a form provided by the Board. Any person, including a building official or the Board itself, may file a complaint. A complaint may allege wrongdoing against an HIC registration and a CSL holder on the same form if the issues giving rise to the filing of the complaint are reasonably related. All complaints must be received by the Board within three years of the date the parties entered into an agreement to perform the work requiring licensure pursuant to these provisions.

110.R5.2.9.1.1 Basis of Complaint. Work related to a specific building permit that is deemed to be in violation of *The Massachusetts Basic and/or One and Two-Family Dwelling Code*, 780 CMR 110R5 or the Home Improvement Contractor Registration Laws and/or regulations, or a consistent pattern of abuse relating to contractual arrangements between license holder and client shall be the basis of such complaint. Any work requiring a building permit which is performed without such permit shall be considered cause for suspension or revocation.

110.R5.2.9.2 Review and Investigation of Complaints. Every complaint filed shall be reviewed by the Board or its designee. If the reviewer determines that the complaint alleges plausible potential violations of 780 CMR by the licensee, a hearing shall be convened. The Board may, if it elects, investigate a complaint prior to scheduling a hearing. Failure of a complainant to cooperate in the investigation shall be grounds for dismissal of a complaint.

If a complaint alleges violations of the Home Improvement Contractor Act (M.G.L. c .142A: *Regulation of Home Improvement Contractors*) and/or 780 CMR 110.R6 in addition to allegations pursuant to the provisions of 780 CMR 110.R5, one hearing may be held on all issues alleged provided that they all arise out of the same set of facts and circumstances.

Upon receipt of a complaint, the Board or its designee shall send a letter acknowledging receipt to the complainant, the licensee being complained of, and the appropriate municipal building official. A copy of the complaint and all attachments shall be mailed to the license holder with the acknowledgment letter

110.R5.2.9.3 Notice of Hearing. If the Hearings Officer or the Board determines that a hearing shall be held to resolve a complaint, reasonable notice shall be provided to the complainant and the license holder. Mailing of notice to the address on record with the BBRS shall be deemed satisfactory notice to the license holder. The notice of hearing shall contain.

1. The name of the complainant.
2. The date, time and place of said hearing.
3. The location of the incident giving rise to the complaint.
4. Notice that either party may view the Board's complaint file by appointment.

110.R5.2.9.4 Hearing. Hearings convened pursuant to this chapter shall be conducted pursuant to 801 CMR 1.02 (Informal/fair hearing rules). Any party may be represented by legal counsel. All parties shall be permitted to present an opening statement, testify on their own behalf, cross-examine all witnesses, present any relevant witness testimony, present any relevant documentary evidence, and offer a closing argument. The Hearing Officer may question any witness and include any records kept by the Board as exhibits. The Hearing Officer may conclude the hearing at any time and issue a decision based on the evidence presented.

If a licensee does not appear for the hearing, the Hearing Officer may conduct a hearing in their absence and render a decision based upon the evidence presented, but only after making a finding that the licensee was provided notice as required by 780 CMR 110.R5.2.9.3.

110.R5.2.9.5 Decisions and Discipline of License Holders. The hearings officer shall issue a written decision after the hearing. Decisions shall be issued in a reasonably prompt manner. The hearing officer may suspend a license for a fixed period of time, revoke a license permanently, or reprimand the licensee. In conjunction with these disciplinary measures, the hearing officer may order the license holder to retake the CSL examination. Any license that is suspended or revoked shall be forwarded to the Board immediately. A person whose license is revoked may apply in writing to the Board for reinstatement no sooner than two years from the date of the revocation.

110.R5.2.10 Appeal. Any person aggrieved by a decision of the hearings officer may, in writing, request review of said decision by the BBRS. The filing of such a petition shall not serve to stay any disciplinary action taken by the Hearings Officer. The BBRS may review such decision at its discretion. Such review is an administrative review that shall be based solely on the administrative record and is not to be construed as a second Hearing on the same complaint(s). After review, the Board may either deny the petition or remand the matter to the Hearings Officer for further proceedings as directed. The filing of an appeal with the Board shall serve to toll the timing provisions of M.G.L. c .30A, § 14 until such time as a final decision is rendered by the Board.

110.R5.2.10.1 Appeal to a Court. Any person aggrieved by a decision of the Hearings Officer or the Board may appeal such decision in conformance with M.G.L. c. 30A, § 14.

110.R5.2.11 Change of Address. The license holder shall have the responsibility of reporting any change of address and/or change of circumstance to the BBRS. The information on file at the BBRS shall be deemed accurate unless changed by the license holder.

110.R5.2.12 On-site Presence of Supervisor. An Unrestricted or Restricted licensed holder or a licensed designee as defined shall be present on the site at some point to approve construction, reconstruction, alterations, removal or demolition involving the following work.

Note: Any Licensed Construction Supervisor who contracts to do work for a homeowner shall be responsible for performing said work in accordance with 780 CMR 51.00 through 99.00, 780 CMR 110.R5 and all reference standards and/or manufacture's recommendations, whether or not the licensed contractor secured the permit for said work:

1. Foundation.
   a. Preparation of bearing material;
   b. Location of foundation;
   c. Placement of forms and reinforcing materials (if applicable);
   d. Placing of concrete (or setting of other foundation materials);
   e. Setting weather protection methods (if required);
   f. Installation of waterproofing and/or dampproofing materials; and
   g. Placement of backfill.

   Note: If encountered in excavating for foundation placement, the licensed construction supervisor shall report the presence of groundwater to the building official and shall submit a report detailing methods of remediation.

2. Structural frame.
   a. Installation of joists, trusses and other structural members and sheathing materials to verify size, species and grade, spacing and attachment\fastening methods. (The licensed construction supervisor shall ensure that any cutting or notching of structural members is performed in accordance with requirements of 780 CMR 51.00 through 99.00.)
   b. Setting of masonry or other structural systems (if used).

3. Energy conservation. Installation of insulation materials, vapor and air infiltration barriers.

4. Fire protection. Installation of smoke, heat and carbon monoxide (CO) detectors and/or systems.

5. Special construction, including, but not limited to:
   a. Chimneys;
   b. Retaining walls over four feet (1219 mm) in height above grade.

The building official may require an unrestricted or restricted license holder or his or her licensed designee to be present on the building site at other points during the construction, reconstruction, alterations, removal or demolition work as he or she deems appropriate.

Exception: Any homeowner performing work for which a building permit is required shall be exempt from the licensing provisions provided that if a homeowner engages a person(s) for hire to do such work, that such homeowner shall act as supervisor and shall be subject to all applicable provisions of 780 CMR 51.00 through 99.00 and 780 CMR 110.R5. This exception shall not apply to the field erection of manufactured buildings constructed pursuant to 780 CMR 51.00 through 99.00 and 780 CMR 110.R3. (See definition of "Homeowner" in 780 CMR 51.00.)

Note: Registered architects and/or professional engineers who secure building permits for and/or perform construction services for detached one- and two-family dwellings are not required to be licensed pursuant to 780 CMR 110.R5 provided that said registered architect or professional engineer secures such permit or performs such services under the responsibilities of his or her professional registration and supervises construction activities as prescribed by 780 CMR 110.R5.2.12.

Exception: An unrestricted or restricted licensed construction supervisor as defined shall be required for installation of manufactured one and two family homes as required by 780 CMR 110.R3.

Masonry Only Construction Supervisor License Holder (MCSL), Residential Roof Covering Construction Supervisor License Holder (RCCSL), Residential Window and Siding (Exterior Weather Protection) Construction Supervisor License Holder (WSCSL), or Residential Solid Fuel-Burning Appliance Installer Construction Supervisor License Holder (SFCSL) shall be present on the job site at such times as deemed necessary to ensure compliance with the *Massachusetts Basic and/or One- and Two-Family Dwelling Code* and780 CMR 110R5.

110.R5.2.13 Lost/Stolen Licenses. License holders are required to keep the license in their possession at all times during the course of construction work at any and all building sites. If said license is lost, stolen or mutilated, it shall be the responsibility of the license holder to notify the BBRS.

110.R5.2.14 Requirement to Show License. Any building official may require the license holder to produce the license at any time on a job site.

110.R5.2.15 Responsibility of Each License Holder.

110.R5.2.15.1 Responsibility for Work. The license holder shall be fully and completely responsible for all work for which he/she is supervising. He/she shall be responsible for seeing that all work is done pursuant to 780 CMR and the drawings as approved by the Building Official.

110.R5.2.15.2 Responsibility to Supervise Work. The construction, reconstruction, alteration, repair, removal or demolition of all detached one- and two-family dwellings or the field erection of any manufactured building shall be under the control of a licensed construction supervisor.

At a minimum, the license holder, as identified on the building permit application, or his or her licensed designee, shall be present on the building site to approve construction, reconstruction, alterations, removal or demolition involving the following work:

1. Foundation:
   (a) Location of and excavation of foundation;
   (b) Preparation of bearing material;
   (c) Placement of forms and reinforcing materials (if applicable);
   (d) Incorporation of vapor retarders (energy conservation)
   (e) Placing of concrete (or setting of other foundation materials);
   (f) Setting weather protection methods (if required);
   (g) Installation of waterproofing and/or damp proofing materials; and
   (h) Placement of backfill.

   Note: If encountered in excavating for foundation placement, the licensed construction supervisor (or registered design professional) shall report the presence of groundwater to the building official and shall submit a report detailing methods of remediation.

2. Structural frame:
   (a) Installation of joists, trusses and other structural members and sheathing materials to verify size, species and grade, spacing and attachment/fastening methods (the licensed construction supervisor shall ensure that any cutting or notching of structural members is performed in accordance with requirements of 780 CMR;

(b) Setting of masonry or other structural systems (if used).

3. Energy conservation: Installation of insulation materials, vapor and air infiltration barriers.

4. Fire protection: Installation of smoke and heat detectors and/or systems.

5. Special construction (including, but not limited to):

(a) Chimneys;

(b) Retaining walls over four feet (1219 mm) in height above grade.

The building official may require the license holder or his or her licensed designee (or registered design professional) to be present on the building site at other points during the construction, reconstruction, alterations, removal or demolition work as he or she deems appropriate.

When required by the building official, at the completion of the work, prior to the issuance of a certificate of occupancy, the licensed construction supervisor, registered professional or homeowner, as applicable, shall submit a copy of the completed checklist contained in Appendix 780 CMR 120.P to the building official in verification that, to the best of his or her knowledge, the work has been executed in accordance with the provisions of 780 CMR.

110.R5.2.15.3 Notification of Violations. The license holder shall immediately notify the building official in writing of the discovery of any violations which are covered by the building permit.

110.R5.2.16 Permit Applications. All building permit applications shall contain the name, signature and license number and the category of license so held of the construction supervisor who is to supervise those persons engaged in construction, reconstruction, alteration, installation repair, removal or demolition as regulated by the *Sixth Edition of the Massachusetts State Building Code*, 780 CMR 108.3.5, 780 CMR 51.00 through 99.00 and 780 CMR 110.R5 in the event that such licensee is no longer supervising said persons, the work shall immediately cease until a successor license holder is substituted on the records of the building department.

110.R5.2.17 Gender of Terms. The term "he" as used in 780 CMR R5 shall include the pronoun "he" and/or "she."

780 CMR 110.R5.3 ADMINISTRATION

110.R5.3.1 Identification. The BBRS shall issue a card or a certificate or other form of identification.

110.R5.3.2 Records of Licensees. The BBRS shall maintain a computer listing which will be available to the public at the office of the BBRS containing all licenses issued by the BBRS.

110.R5.3.3 Examination. The Board shall determine whether an examination shall be required, or shall be oral or written and shall determine the content of the examination, if applicable.

110.R5.3.4 Subject to Rules, Regulations and Procedures. All persons licensed shall be subject to 780 CMR 110.R5, as well as other rules, regulations, and procedures promulgated by this BBRS.

110.R5.3.5 Fees. Any and all fees charged for license fees, examination fees, renewal fees, and registration fees shall be determined by the Commonwealth and enforced by the BBRS. Examination fees shall be established from time to time as necessary.

780 CMR 110.R6

REGISTRATION AND ENFORCEMENT OF HOME IMPROVEMENT CONTRACTOR PROGRAM

(Note: This Regulation is unique to Massachusetts)

FORWARD

780 CMR 110.R6 covers the registration of home improvement contractors and subcontractors and enforcement of the requirements of M.G.L. c. 142A as they pertain to home improvement contractors and subcontractors. Other regulations applicable to the Home Improvement Contractor program include:

201 CMR 14.00. Operation of the home improvement arbitration program authorized by M.G.L. c. 142A, promulgated by the secretary of the Office of Consumer Affairs and Business Regulations.

201 CMR 15.00. Operation of the home improvement guaranty fund, promulgated by the secretary of the Office of Consumer Affairs and Business Regulations.

780 CMR 110.R6.1 General Provisions

110.R6.1.1 Authority
110.R6.1.2 Definitions
110.R6.1.3 Scope
110.R6.1.4 Administration and Enforcement
  110.R6. 1.4.1 Director responsibility
  110.R6.1.4.2 Advisory board
110.R6.1.5 Persons Who Must Register
  110.R6.1.5.1 Filing of application
  110.R6.1.5.2 Designated individual
  110.R6.1.5.3 Liability
110.R6.1.6 Persons Exempt From Registration

780 CMR 110.R6.2 Registration Procedure

110.R6.2.1 Applicant Actions
  110.R6.2.1.1 Application
  110.R6.2.1.2 Supporting documentation
  110.R6.2.1.3 Mailing address
  110.R6.2.1.4 Certified check/money order
  110.R6.2.1.5 Lost/destroyed certificate
  110.R6.2.1.6 Licensee liability
110.R6.2.2 Director's Action on Application
  110.R6.2.2. 1 Issuance of certificate
  110.R6.2.2.2 Grounds for refusal to register
  110.R6.2.2.3 Application refused
  110.R6.2.2.4 Record retention
110.R6.2.3 Duration of Registration
110.R6.2.4 Fees to be Paid Upon Registration or Renewal
  110.R6.2.4.1 Registration and renewal fee
  110.R6.2.4.2 Contribution to guaranty fund-initial registration
110.R6.2.5 Responsibilities of Each Registrant
  110.R6.2.5.1 Changes in status
  110.R6.2.5.2 Display of certificate number
  110.R6.2.5.3 Return of certificate

780 CMR 110.R6.3 Enforcement Procedure

110.R6.3.1 Notification of Violation
110.R6.3.2 Consideration of Factors
110.R6.3.3 Letter of Reprimand
110.R6.3.4 Suspension, Revocation, Administrative Penalties
  110.R6.3.4.1 Hearing procedure
110.R6.3.5 Injunction, Restitution
110.R6.3.6 Fines and Criminal Penalties

780 CMR 110.R6.4 Enforcement Actions

110.R6.4.1 Administrative Penalties
  110.R6.4.1.1 Allowable actions
  110.R6.4.1.2 Pendency of claims
110.R6.4.2 Fines and Criminal Penalties
  110.R6.4.2.1 Sought by attorney general or district attorney
  110.R6.4.2.2 Operating without certificate
  110.R6.4.2.3 Other violations
110.R6.4.3 Injunction, Restitution
  110.R6.4.3.1 Order from superior court
  110.R6.4.3.2 Director bond not required
110.R6.4.4 Permit Requirements, Prohibited Acts and Penalties
  110.R6.4.4.1 Permit requirements
  110.R6.4.4.2 Prohibited acts
  110.R6.4.4.3 Penalties
  110.R6.4.4.4 Deceptive act

780 CMR 110.R6.5 Contracts

110.R6.5.1 Contract in Writing
110.R6.5.2 Contents of Contract
  110.R6.5.2.1 Documents and information
  110.R6.5.2.2 Permit notice
  110.R6.5.2.3 Acceleration of payment
  110.R6.5.2.4 Copy to owner
  110.R6.5.2.5 Alternative dispute resolution
110.R6.5.3 Dispute Resolution
  110.R6.5.3.1 Court action
  110.R6.5.3.2 Owner right to arbitration
  110.R6.5.3.3 Contractor right to arbitration
110.R6.5.4 Validity of contract

780 CMR 110.R6.6 Supplementary Identification Cards

110.R6.6.1 Definitions
110.R6.6.2 Certificates of registrants
  110.R6.6.2.2 Non-Individual Registrants
110.R6.6.3 Fees
110.R6.6.4 Expiration

780 CMR 110.R6.1 GENERAL PROVISIONS

110.R6.1.1 Authority. 780 CMR 110.R6 is authorized and promulgated by the administrator of the State Board of Building Regulations and Standards under the authority of M.G.L. c. 142A, § 16 and M.G.L. c. 143, § 94(g).

110.R6.1.2 Definitions.

APPLICATION. The form provided by the director which, along with other documentation and fee(s) that may be required, must be duly filed to become a registered home improvement contractor or subcontractor.

ADVERTISEMENT. Any commercial message in any newspaper, magazine, leaflet, flyer, catalog, display space in the telephone book, on radio, television, public address system, on the internet or made in person, by letter or other printed material, or any interior or exterior sign or display, including on a vehicle, which is delivered or made available to the public or a specific individual in any manner whatsoever.

APPLICANT. Any person who files an application to become registered as a home improvement contractor or subcontractor.

BBRS or Board. The State Board of Building Regulations and Standards.

CERTIFICATE. The document provided to the registrant which lists the certificate number and other information required by the director.

CERTIFICATE NUMBER. See registration number.

CLEAR AND CONSPICUOUS. The material representation being disclosed is of ten point type and is so presented as to be readily noticed and understood by a reasonable person. Language in the body of a contract is "conspicuous" if it is in larger or contrasting type or color, or underscored.

CONTRACT. Unless specifically noted otherwise in the text, a written agreement between a home improvement contractor and an owner contained in one or more documents for the performance of certain residential contracting work, including all labor, material, goods and services set forth under said agreement for a total amount exceeding $1,000.00.

CONTRACTOR. Any person who, through himself or others, undertakes, offers to undertake, purports to have the capacity to undertake, or submits a bid for construction work. (See "home improvement contractor")

DIRECTOR. The administrator of the State Board of Building Regulations and Standards, or their designee(s).

EMPLOYEE. For the purposes of 780 CMR 110.R6 in determining the number of employees of an applicant for registration, any individual engaged in construction related activities who, in the weekly pay period prior to the date of registration worked 20 or more hours for the registrant and for whom, the registrant withheld or was required to withhold federal or state income taxes and who, during the same pay period, was not otherwise paid or had such taxes withheld by any other registrant. Included would be all construction workers, supervisors, sales personnel, designers, estimators, active partners and officers of corporations.

FUND. The residential contractor's guaranty fund. See "guaranty fund."

FUND ADMINISTRATOR. the administrator of the residential contractor's guaranty fund, appointed by the secretary of the Office of Consumer Affairs and Business Regulation.

GUARANTY FUND. The residential contractor's guaranty fund. A fund out of which an owner, as defined herein, aggrieved by a registrant(s) may be paid part or all of their damages under rules and regulations promulgated by the secretary of the Office of Consumer Affairs and Business Regulation.

HOME IMPROVEMENT CONTRACTOR. Any person who owns or operates a contracting business who, through himself or others, undertakes, purports to have the capacity to undertake, offers to undertake, or submits a bid for residential contracting work to an owner, as such work is defined in 780 CMR 110.R6 and M.G.L. c. 142A, and such work for each project is in a total amount in excess of $1,000.00, and is registered or required to be registered in accordance with M.G.L. c. 142A and 780 CMR 110.R6.

HOMEOWNER. See "Owner."

LOCAL CONSUMER GROUP. A local or regional agency which deals with the resolution of consumer problems and who is determined eligible by the attorney general under standards set by the attorney general in accordance with M.G.L. c. 12, § 11G.

MORTGAGE BROKER. Any person, who, for compensation or gain, or in the expectation of compensation or gain, directly or indirectly negotiates, places, assists in placement, finds or offers to negotiate, place, assist in placement of mortgage loans on residential property for others, or as otherwise defined in M.G.L. c. 255E.

MORTGAGE LENDER. Any person engaged in the business of making mortgage loans, or issuing commitments to fund mortgage loans, or accepting applications or fees associated with the making of mortgage loans which are secured by a mortgage on residential property, or as otherwise defined in M.G.L. c. 255E.

MORTGAGE LOAN. A loan to any person made primarily for personal, family, or household purposes, secured wholly or partially by a mortgage on a residential property, or as otherwise defined by M.G.L. c. 255E.

OWNER. Any homeowner of a building which is an existing building at the time of a contract that is owner occupied, containing at least one but not more than four dwelling units, or a tenant authorized by the homeowner thereof, who orders, contracts for, or purchases the services of a contractor or subcontractor. An owner occupying a condominium unit in a building containing no more than four dwelling units qualifies as an owner under this definition, provided the owner owns a total of not more than four condominium units. A condominium association does not qualify as an owner.

OWNER-OCCUPIED. The residential building of at least one but not more than four dwelling units and occupied by the owner as a primary residence.

PERMIT. For the purposes of 780 CMR 110.R6, any construction-related permit, excluding any permits required by the owner which are not considered construction-related, such as zoning, environmental, historical commission, and the like.

PERSON. Any individual, partnership, corporation, society, trust, association, or any other legal entity.

REGISTRANT. Any duly registered home improvement contractor or subcontractor.

REGISTRATION NUMBER. The number assigned to the applicant after he has been approved for registration by the director and the Board of Building Regulations and Standards.

RESIDENTIAL CONTRACTING. The reconstruction, alteration, renovation, repair, modernization, conversion, improvement, removal or demolition or the construction of an addition to any pre-existing owner-occupied building containing at least one but not more than four dwelling units, which building or portion thereof is used or designed to be used as a residence or dwelling unit, or to structures which are adjacent and accessory to such residence or building, including but not necessarily limited to. garages, sheds, cabanas, poolhouses, gazebos.

SALESPERSON. any person, other than a supplier of materials or a laborer, who solicits, offers, negotiates, executes, or otherwise endeavors to procure by any means whatsoever, directly or indirectly, a contract for residential contracting services from an owner on behalf of a home improvement contractor or subcontractor.

SECRETARY. The secretary of the Office of Consumer Affairs and Business Regulations.

SUBCONTRACT. A contract, written or verbal, in any amount, between a home improvement contractor and a subcontractor or between two subcontractors for the performance of any part of the home improvement contractor's or subcontractor's contract.

SUBCONTRACTOR. Any person, other than a supplier of only materials, who enters into a contract, written or verbal, with a home improvement contractor for the performance of any part of a home improvement contractor's contract with an owner for residential contracting, or who enters into a contract with any other subcontractor for the performance of any part of the subcontractor's contract.

110.R6.1.3 Scope.

110.R6.1.3.1 M.G.L. c. 142A and 780 CMR 110.R6 require the registration of persons who engage in residential contracting work as defined in 780 CMR 110.R6 and M.G.L. c. 142A after July 1, 1992, and define the requirements of M.G.L. c. 142A and enforcement of these requirements, as they pertain to home improvement contractors and subcontractors.

110.R6.1.3.2 Except for those persons who are specifically exempt from the provisions of 780 CMR 110.R6 and M.G.L. c. 142A, all contractors and subcontractors who engage in residential contracting as defined in 780 CMR 110.R6 and M.G.L. c. 142A shall be subject to and shall comply with 780 CMR 110.R6 and M.G.L. c. 142A.

110.R6.1.4 Administration and Enforcement.

110.R6.1.4.1 Director Responsibility. The director shall promulgate and enforce the provisions of 780 CMR 110.R6 and M.G.L. c. 142A as to all home improvement contractors and subcontractors who are registered or required to register.

110.R6.1.5 Persons Who Must Register.

110.R6.1.5.1 General. All home improvement contractors and subcontractors, as defined in 780 CMR 110.R6, except those exempt in 780 CMR 110.R6.1.6, shall register with the director by filing an application prescribed by the director.

110.R6.1.5.2 Designated Individual. In the case of registration by a corporation or partnership, an individual shall be designated to be responsible for the corporation's or partnership's residential contracting work.

110.R6.1.5.3 Liability. The corporation or partnership and its designee shall be jointly and severally liable for the payment of the registration fee, the payment to the guaranty fund, and for violations of any provisions of 780 CMR 110.R6, including actions by the registrant's employees, subcontractors or salespersons.

110.R6.1.6 Persons Exempt from Registration or Renewal. Any person exempt from registration under 780 CMR 110.R6.1.6, and does not voluntarily register, is not subject to any of the provisions of 780 CMR 110.R6 or M.G.L. c. 142A. Persons exempt from registration are:

1. The Commonwealth or its political subdivisions;
2. Any school, public or private, offering as part of a vocational education program courses and training in any aspects of home construction or home improvements;
3. Electricians, plumbers, architects or any other persons who are required by law to attain standards of competency or experience as a prerequisite to licensure for and engaging in such trade or profession and who are acting exclusively within the scope of the profession for which they are currently licensed pursuant to such law, construction supervisors excepted.
4. Persons dealing in the sale of goods or materials who neither arrange to perform nor perform directly or indirectly any work or labor in connection with the installation of or application of the goods or materials;
5. Any owner personally doing residential contracting work on his/her own home;
6. Any individual who performs construction related labor or services for a home improvement contractor or subcontractor, for wages or salary and who does not act in the capacity of a home improvement contractor or subcontractor;
7. Any contractor or subcontractor who works on one residential contracting undertaking or project by one or more contracts where the aggregate contract price to the owner is less than $500.00; provided, however, that the contract is not in an amount of less than $500.00 for the purpose of evading 780 CMR 110.R6 or M.G.L. c. 142A.
8. Any person who engages in the business of a home improvement contractor or subcontractor on other than a full-time basis, and who has earned in gross revenues from residential contracting work, less than $5,000.00 in the previous 12-month period;
9. Any person acting as a home improvement contractor or subcontractor who was enrolled as a full-time student in a secondary school or college with degree granting authority from the government of the state in which the school is located, for the immediately preceding academic semester and is also enrolled as a full-time student for the next academic semester, in the same or a similar degree granting secondary school or college provided that at least ⅔ of the number of employees of the contractor or subcontractor are similarly enrolled in secondary schools or colleges and that the home improvement contractor or subcontractor does not reasonably expect to earn or does not in fact earn, in gross revenues, more than $5,000.00 from residential contracting work;
10. Persons who install any or all of the following:
    a. central heating,
    b. air-conditioning systems,
    c. energy-conservation devices, or
    d. provides conservation services conducted by or on behalf of a public utility under a program approved by the department of public utilities.
11. Any contractor or subcontractor who works exclusively in any of the following home improvement areas:
    a. landscaping;
    b. interior painting or wall covering;
    c. finished floor covering, including, but not limited to, carpeting, vinyl, tile, nonstructural hardwood;
    d. fencing or freestanding masonry walls;
    e. above-ground swimming pools;
    f. shutter or awning installation;
    g. ground level patios; includes flagstone, concrete, block, and wood set directly onto the ground; excludes decks which are supported above ground;
    h. asphalt and driveway installation and maintenance.

780 CMR 110.R6.2 REGISTRATION PROCEDURE

110.R6.2.1 Applicant Actions.

110.R6.2.1.1 Application. Each applicant for registration as a home improvement contractor or subcontractor shall submit a completed copy of an application form supplied by the director and necessary supporting documents to the director, along with such fees as required by the provisions of 780 CMR 110.R6.2.4, and M.G.L. c. 142A.

110.R6.2.1.2 Supporting Documentation. Supporting documentation shall include, as applicable:

1. For Corporations. An official document which lists the names and addresses of officers, directors, and major stockholders such as. A copy of the articles of incorporation, a current annual report as filed with the Secretary of State, a copy of the registration as a foreign corporation filed with the Secretary of State, or any other documentation which lists the names and addresses of officers, directors, and major stockholders, will be accepted in lieu of listing these names on the application.
2. For Partnerships. Either a copy of the current partnership agreement containing the requested information, or listing of the names and addresses of all partners on the application form.
3. For all Non-corporate Applicants. A copy of the business registration certificate filed with a city or town pursuant to M.G.L. c. 110,

§ 5, if applicable.

110.R6.2.1.3 Mailing Address. The application, supporting documentation and fees may be mailed or delivered as follows:

Director
Home Improvement Contractor Registration
One Ashburton Place, Room 1301
Boston, MA 02108

It shall be the responsibility of the applicant to assure that the required registration material is received by the director.

110.R6.2.1.4 Certified Check/Money Order. All applications shall be accompanied by the registration fee or by evidence of exemption, and by the fee for the guaranty fund. Fees shall be in the form of a money order or certified check. Two money orders or certified checks shall be included - one for the registration fee, if required, and one for the guaranty fund. Make checks or money orders payable to the Commonwealth of Massachusetts.

As noted in 780 CMR 110.R6.2.4.1.2, licensed individual construction supervisors and individual motor vehicle repair shops who desire to register are exempt from the registration fee only; there are no exemptions to the requirement for a contribution to the guaranty fund.

110.R6.2.1.5 Lost/Destroyed Certificate of Registration. Upon receipt of a nominal fee as established by the Commonwealth, and a completed affidavit provided by the director, that a certificate of registration has been lost or destroyed, a replacement certificate clearly identified as such, shall be issued by the director.

110.R6.2.1.6 Licensee Liabilities. The provisions of 780 CMR 110.R6 and those of M.G.L. c. 142A shall not be construed to relieve or lessen the responsibility of any person registered under 780 CMR 110.R6 and M.G.L. c. 142A or licensed under M.G.L. c. 143, § 94(i), nor shall the Commonwealth be deemed to have assumed any such liability by reason of the issuance of registration or licensure.

110.R6.2.2 Director's Action on Application.

110.R6.2.2.1 Issuance of Certificate. Upon receipt of a completed application form, supporting documentation, and the proper fee(s) therefor, the director shall ascertain whether such applicant meets all of the registration requirements and there are no grounds for rejection as specified in 780 CMR 110.R6.2.2.2; if all requirements are met, the Director, within 30 days of receipt of the application shall assign a registration number, with the approval of the BBRS; prepare and send by first class mail to such applicant, at the address stated on the registration form, a certificate indicating the applicant's registration number, name, address, name of the entity of the applicant, and such other information as is deemed necessary by the director. The registration certificate is not transferable to any other person.

110.R6.2.2.2 Grounds for Refusal to Register or Renew. No application for registration or renewal conforming to 780 CMR 110.R6 and M.G.L. c. 142A may be denied except for a finding by the director that the applicant has done one or more of the following acts which are grounds for denial after the effective date of 780 CMR 110.R6.

1. Made material omissions or mis-representations of fact on the home improvement contractor or subcontractor application for registration or renewal and supporting documentation or on an application for licensure or renewal under M.G.L. c. 143, § 94(i). (construction supervisor license);
2. Failed to pay either the registration fee or the payment to the fund as required under 780 CMR 110.R6.2.4.
3. Failed consistently to perform contracts or has performed said contracts in an unworkmanlike manner or has failed to complete said contracts with no good cause or has engaged in fraud or bad faith with respect to said contracts;
4. Failed to meet or has violated any of the requirements for registered home improvement contractors or subcontractors as defined in 780 CMR 110.R6, or has performed or is attempting to perform any act prohibited by 780 CMR 110.R6 and M.G.L. c. 142A.
5. Is under suspension or revocation of registration as a home improvement contractor or subcontractor;
6. Has failed to repay the guaranty fund for any payments made by the fund on the registrant's account.
7. Any act, set of circumstances, which demonstrate that it would be counter to the consumer protection aims of M.G.L. c. 142A to issue a registration.

110.R6.2.2.3 Application Refused. If the application is refused, the director shall, within 30 days of the application, notify the applicant in writing by first class mail of the reasons for the rejection.

110.R6.2.2.3.1. If applicable, the applicant may correct the deficiencies in the application material and return the corrected data to the director within ten days of the date of mailing of the director's notice of refusal, who will then assign a registration number and issue a certificate.

110.R6.2.2.3.2. If the grounds for rejection are based upon substantive grounds for refusal of 780 CMR 110.R6.2.2.2, and M.G.L. 142A, the applicant may request that the director reconsider the application as submitted by stating his/her reasons therefore, in writing, within ten days of the date of mailing of the notice of the director's rejection of the application.

110.R6.2.2.4 Record Retention. The director shall keep a record of the date the application and all pertinent documents are received. In addition, the director shall keep on file, in convenient form and open to public inspection, all applications for registration, copies of certificates issued, and the names of all home improvement contractors or subcontractors whose registration has been revoked, suspended or surrendered.

110.R6.2.3 Duration of Registration.

110.R6.2.3.1 Initial Registration. Each such registration shall be in effect for two years from the date of issuance, unless suspended or revoked prior to that time, as provided in 780 CMR110.R6 and M.G.L. c. 142A.

110.R6.2.3.2 Renewal of Registration. Not less than 90 days before the date of the expiration of such registration, the director shall send or cause to be sent, to each registered contractor or subcontractor, at the address on record, a notice for renewal of the registration and a copy of all forms necessary for such renewal, by first class mail, along with a schedule of such fees as are necessary for said renewal. Renewals will remain in effect for two years from date of renewal if not suspended or revoked prior to that time. The responsibility for timely renewal of registration remains with the registrant, notwithstanding this notice. An applicant shall submit a renewal application with fees within one year of the expiration date of the registration. Failure to submit a renewal application within this time period shall subject the applicant to a fee equal to the amount for initial registration.

110.R6.2.4 Fees to be Paid upon Registration or Renewal.

110.R6.2.4.1 Registration and Renewal Fee. All home improvement contractors and subcontractors, except those that are exempt from the registration or renewal fee in 780 CMR 110.R6.2.4.1.2, shall, at the time of registration or renewal, pay to the Commonwealth, a fee in the amount of the fee then being charged for the construction supervisor's license under M.G.L. c. 143, § 94(I).

110.R6.2.4.1.2 Exemptions from Registration and Renewal Fee.

1. Every individual construction supervisor licensed by the BBRS in accordance with M.G.L. c. 143, § 94(i), and every individual motor vehicle repair shop registered in accordance with M.G.L. c. 100A, § 2, who desires to be registered or renew their registration as a home improvement contractor or subcontractor, and whose license or registration fee has been paid and is current, shall be deemed to have paid the registration fee required by 780 CMR 110.R6.2.4.1.
2. If the applicant is a corporation or partnership and the named individual responsible for home improvement contracting work is a licensed construction supervisor and a substantial owner (10% or more of ownership), the applicant entity is exempt from the registration and renewal fee.

110.R6.2.4.2 Contribution to Guaranty Fund-initial Registration. At the time of initial registration, contractors and subcontractors shall also pay to the Commonwealth, in a separate certified check or money order from the stated registration fee, if any, a fee payable to the guaranty fund.

110.R6.2.4.2.1. The fee paid by contractors and subcontractors to the guaranty fund shall be determined based on the number of employees (active construction-related personnel) of the home improvement contractor or subcontractor, as defined in 780 CMR 110.R6.1.2, on the date of initial registration, as follows:

1. Zero to three employees $100.00
2. four employees up to and including ten $200.00
3. 11 employees up to and including 30 $300.00
4. More than 30 employees $500.00

110.R6.2.4.2.2. The fee to the guaranty fund shall be paid by every registered home improvement contractor and subcontractor regardless of whether such registrant is exempt from paying the registration fee because of the home improvement contractor or subcontractor's status as a licensed construction supervisor or registered motor vehicle repair shop owner.

110.R6.2.4.2.3. Any registrant who fails to accurately determine the number of employees and pay the correct fee therefor shall be deemed to have failed to pay the fees required for registration and shall be subject to enforcement action by the director, in accordance with 780 CMR 110.R6.2.2.2, 4.1 and 4.3.

110.R6.2.4.2.4. No home improvement contractor or subcontractor shall be required to pay the contribution to the guaranty fund more than once unless the fund administrator determines that the amount of the fund is insufficient to maintain it at a level commensurate with claims made against the fund. If such a determination is so made, after conducting a public hearing, the director, in consultation with the fund administrator, may assess each registered home improvement contractor or subcontractor an appropriate fee, the amount to be determined by the commissioner of administration and finance, which shall not exceed the amount of the original assessment; provided, however, that the director shall not assess any registrant more than once in any 12-month period.

110.R6.2.5 Responsibilities of Each Registrant.

110.R6.2.5.1 Changes in Status. Each registrant shall be responsible for reporting, in writing, within 30 days, changes in trade name or address or additions of business name(s), and any other pertinent changes in circumstances to the director.

110.R6.2.5.2 Display of Certificate Number. Every contract, building permit and advertisement for residential contracting as defined in 780 CMR 110.R6 shall display the home improvement contractor's or subcontractor's certificate of registration number.

110.R6.2.5.3 Return of Certificate. Upon the expiration, termination or voluntary surrender of a registration, the registrant shall deliver the certificate to the director who shall cancel the registration and endorse the date of expiration, termination or surrender. In such case, no further residential contracting work will be engaged in by the contractor or subcontractor.

780 CMR 110.R6.3 ENFORCEMENT AND COMPLAINT PROCEDURES

110.R6.3.1 Basis of Complaint:. Only work performed pursuant to a contract between a homeowner and a contractor may be the basis of such complaint.

110.R6.3.2 Complaints. All complaints against a contractor must be in writing on a form provided by the director. Any person, building official, the Guarantee Fund administrator, or the Board may file a complaint. A complaint may allege wrongdoing against an HIC registration and a CSL holder on the same complaint form if the issues giving rise to the filing of the complaint are reasonably related. All complaints must be received by the Board within three years from the date the contract giving rise to the complaint was entered into by the parties.

110.R6.3.3 Review and Investigation of Complaints. Every complaint filed shall be reviewed by the director. If the director determines that the complaint alleges plausible potential violations by the contractor of 780 CMR or M.G.L. c. 142A, a hearing shall be convened. The director may investigate a complaint prior to scheduling a hearing. Failure of a complainant to cooperate in the investigation shall be grounds for dismissal of a complaint.

If a complaint alleges violations of 780 CMR 110.R5 in addition to allegations pursuant to the provisions of 780 CMR 110.R6, one hearing may be held on all issues alleged provided that they all arise out of the same set of facts and circumstances.

Upon receipt of a complaint, the director shall send a letter acknowledging receipt to the complainant, the registration holder complained of, and the appropriate municipal building official. A copy of the complaint and all attachments shall be mailed to the registration holder with the acknowledgment letter.

110.R6.3.4 Notice of Hearing. If the director determines that a hearing shall be held to resolve a complaint, reasonable notice of the hearing shall be provided to the complainant and the complained of registration holder. Mailing of the notice to the address on record with the BBRS shall be deemed satisfactory notice to the registrant. The notice of hearing shall contain:

1. The name of the complainant.
2. The date, time and place of said hearing.
3. The location of the incident giving rise to the complaint.
4. Notice that either party may review the Board's complaint file by appointment.

110.R6.3.5 Hearing. Hearings held pursuant to this chapter shall be conducted pursuant to 801 CMR 1.02: *Informal/Fair Hearing Rules*. Any party may be represented by legal counsel. At the hearing, all parties shall be permitted to present an opening statement, testify on their own behalf, cross-examine all witnesses, present any relevant witness testimony, present any relevant documentary evidence, and offer a closing argument. The Hearing Officer may question any witness and include any records kept by the Board as exhibits. The Hearing Officer may, at their discretion, conclude the hearing at any time and issue a decision based on the evidence presented.

If a contractor does not appear for the hearing, the Hearing Officer may conduct a hearing and render a decision based upon the evidence presented only after making a finding that the contractor was provided reasonable notice of the hearing as required by 780 CMR 110.R6.3.4.

110.R6.3.6 Decisions and Discipline of License Holders. The Hearings Officer shall issue a written decision after the hearing. Decisions shall be issued in a reasonably prompt manner. The hearing officer may suspend a registration for a fixed period of time, revoke a registration permanently, or reprimand the registration holder. In conjunction with these disciplinary measures, the hearing officer may assess a fine of up to $2000 for each violation found. Any registration that is suspended or revoked shall be forwarded to the Board immediately. A person or entity whose registration is revoked may apply in writing to the Board for reinstatement no sooner than two years from the date of the revocation.

110.R6.3.7 Cause for Reprimand, Suspension or Revocation. The following shall be grounds for reprimand, suspension or revocation of a home improvement contractor registration:

1. the applicant made a false statement on their application for registration;
2. a registrant made a false statement to the Board;
3. any violation of 780 CMR;
4. the registrant failed to fully cooperate with the director's investigation into a complaint;
6. the registrant failed to turn over a suspended registration to the director;
7. the registrant failed to abide by a mandate or order of the director or Board; or
8. the registrant committed an act prohibited by M.G.L. c. 142A, § 17 or any other provision of M.G.L. c.142A.

110.R6.3.8 Appeal. Any person aggrieved by a decision of the Hearings Officer may, in writing, request review of said decision by the Board. The filing of such a petition shall not serve to stay any disciplinary action taken by the Hearings Officer. The Board may review such decision at its discretion. Such review is an administrative review that shall be based solely on the administrative record and is not to be construed as a second Hearing on the same complaint. After review, the Board may either deny the petition or remand the matter to the Hearings Officer for further proceedings as directed. The filing of an appeal with the Board shall serve to toll the timing provisions of M.G.L. c. 30A, § 14 until such time as a final decision is rendered by the Board.

780 CMR 110.R6.4 ENFORCEMENT ACTIONS

110.R6.4.1 Administrative Penalties. If the director determines that any registrant is liable for a violation of any of the provisions of 780 CMR 110.R6 or M.G.L. c. 142A, the director may institute one or more of the following actions.

110.R6.4.1.1 Allowable Actions.

1. Suspend the registrant's certificate of registration for such period of time as shall be determined by the director;
2. Revoke the registrant's certificate of registration;
3. Send a letter of reprimand to the registrant; and
4. Assess an administrative penalty not to exceed $2,000.00, payable within 30 days of the date of the order of assessment, for each violation of any provisions of 780 CMR 110.R6 and M.G.L. c. 142A committed by the home improvement contractor(s) or subcontractor(s) who are registered or required to be registered under 780 CMR 110.R6. This penalty shall be deposited to the fund.

110.R6.4.1.2 Pendency of a Claim. The pendency of a claim against the fund shall not limit the director from taking enforcement action against any registrant pursuant to 780 CMR 110.R6 or M.G.L. c. 142A.

110.R6.4.2 Fines and Criminal Penalties.

110.R6.4.2.1 Sought by Attorney General or District Attorney. Fines and imprisonment specified in 780 CMR 110.R6 and M.G.L. c. 142A may be sought by the attorney general or a district attorney, and such fines and imprisonment shall be in addition to any administrative penalty otherwise applicable thereto.

110.R6.4.2.2 Operating Without a Certificate. Any home improvement contractor or subcontractor who shall knowingly, willfully, or negligently operate without obtaining a certificate of registration as required by 780 CMR 110.R6 and M.G.L. c. 142A and who is not otherwise exempt from the registration requirements or any home improvement contractor or subcontractor who continues to operate after revocation of or during suspension of, or who had failed to renew his certificate of registration, shall be punished by a fine not exceeding $5,000.00 or imprisonment not exceeding two years or both.

110.R6.4.2.3 Other Violations. Any person who knowingly and willfully violates any of the provisions of 780 CMR 110.R6 or M.G.L. c. 142A, with respect to which a greater penalty is not otherwise provided by the provisions of 780 CMR 110.R6 or M.G.L. c. 142A or by any other law may be punished by a fine of not more than $2,000.00 or by imprisonment for not more than one year or both.

110.R6.4.3 Injunctions, Restitution.

110.R6.4.3.1 Order from Superior Court. If the director concludes that the continuing conduct of any person alleged to be in violation of 780 CMR 110.R6 and M.G.L. c. 142A may result in substantial or irreparable harm to any citizen of the Commonwealth, the director may seek:

1. A permanent or temporary injunction with respect to the conduct from the superior court of any county in which the alleged violation is occurring, or in which the violator has its principal place of business; or
2. An order requiring restitution or satisfactory completion of the home improvement contractor's contract with an owner.

110.R6.4.3.2 Bond Not Required. The director shall not be required to file a bond or to show a lack of an adequate remedy at law when seeking an injunction under M.G.L. c. 142A against any person, association, partnership, or corporation not registered under 780 CMR 110.R6 and M.G.L. c. 142A.

110.R6.4.4 Prohibited and Deceptive Acts.

110.R6.4.4.1 Prohibited Acts. The following acts are prohibited by registered home improvement contractors or subcontractors, and those required to register under the provisions of 780 CMR 110.R6 and M.G.L. c. 142A.

1. Operating without a certificate of registration issued by the director;
2. Abandoning or failing to perform, without justification, any contract or project engaged in or undertaken, or deviating from or disregarding plans or specifications in any material way without the consent of the owner, except for changes in plans, specifications, or construction techniques required by building regulations;
3. Failing to credit the owner any payment they have made to the contractor or his salesperson in connection with a residential contracting transaction;
4. Making any material misrepresentation in the procurement of a contract or making any false promise of a character likely to influence, persuade or induce the procurement of contract;
5. Acting directly, regardless of the receipt or expectation of receipt of compensation or gain from the mortgage lender, in connection with a residential contracting transaction by preparing, offering or negotiating or attempting to or agreeing to prepare, arrange, offer or negotiate a mortgage loan on behalf of a mortgage lender;
6. Acting as a mortgage broker or agent for any mortgage lender;
7. Publishing, directly or indirectly, any advertisement relating to residential contracting which does not contain the home improvement contractor's or subcontractor's certificate of registration number or which does contain an assertion, representation or statement of fact which is false, deceptive, or misleading;
8. Advertising in any manner that a registrant is registered under 780 CMR 110.R6 unless the advertisement includes an accurate reference to the home improvement contractor's or subcontractor's certificate of registration;
9. Violating any of the building laws of the Commonwealth or of any political subdivision thereof;
10. Misrepresenting a material fact by an applicant in obtaining a certificate of registration;
11. Failing to notify the director of any change of trade name or address as required by 780 CMR 110.R6.2.5.1;
12. Conducting a residential contracting business in any name other than the one in which the home improvement contractor or subcontractor is registered;
13. Failing to pay for materials or services rendered in connection with his/her operating as a home improvement contractor or subcontractor where he/she has received sufficient funds as payment for the particular construction work, project or operation for which the services or materials were rendered or purchased;
14. Failing to comply with any order, demand or requirement lawfully made by the director or fund administrator under and within the authority of 780 CMR 110.R6 and M.G.L. c. 142A;
15. Demanding or receiving payment in violation of 780 CMR 110.R6.5.2. Item 5, 6, or 5.2.2;
16. Violating any other provisions of 780 CMR 110.R6 and M.G.L. c. 142A;
17. Failing to pay to the guaranty fund in full, including interest, any amount paid from said fund because of the conduct of the registrant;
18. Any of the grounds for refusal to register or renew in 780 CMR 110.R6.2.2.2 are also considered prohibited acts;
19. Failing, within 21 days, to comply with, or advise the owner of intent to comply with, or appeal the decision of, an arbitrator as provided for in M.G.L.c. 142A and 201 CMR 14.00;
20. Failing to display the registration number on every contract, building permit and advertisement as required by 780 CMR 110.R6.5.2.1 Item 2, 110.R6.4.4.1 Item 2, 110.R6.4.4.2 Item 7, and 110.R6.4.4.2 Item 8.

110.R6.4.4.2 Deceptive Act. Violations of any of the provisions of 780 CMR 110.R6 and M.G.L. c. 142A shall constitute an unfair or deceptive act under the provisions of M.G.L. c. 93A.

780 CMR 110.R6.5 CONTRACTS

110.R6.5.1 Contract in Writing. Every agreement between a home improvement contractor and an owner to perform residential contracting services in an amount in excess of $1,000.00 shall be in writing.

110.R6.5.2 Contents of Contract.

110.R6.5.2.1 Documents and Information. Every agreement to perform residential contracting services in excess of $1,000.00 shall include, but not be limited to, the following documents and information:

1. The complete agreement between the owner and the contractor and a clear description of any other documents which are or shall be incorporated into said agreement;
2. The full names, federal ID number if applicable, (exclusive of social security number), address (exclusive of post office box addresses), registration number of the home improvement contractor, the name(s) of the

salesperson(s), if any, who solicited or negotiated the contract and the date when said contract was executed by the parties;

3. The date on which the work under the contract is scheduled to begin and the date on which said work is scheduled to be substantially completed;

4. A detailed description of the work to be done and the materials to be used;

5. The total amount agreed to be paid for the work to be performed under the contract;

6. A time schedule of payments to be made under said contract and the amount of each payment stated in dollars, including all finance charges, if any. Any deposit required under the contract to be paid in advance of the commencement of work under said contract shall not exceed the greater of ⅓ of the total contract price or the actual cost of any material or equipment of a special order or custom made nature, which must be ordered in advance of the commencement of the work, in order to assure that the project will proceed on schedule. No final payment shall be demanded until the contract is completed to the satisfaction of the parties thereto;

7. The signature of all parties shall be affixed to the contract;

8. There shall be a clear and conspicuous notice appearing in the contract stating:

a. That all home improvement contractors and subcontractors shall be registered by the director and that any inquiries about a contractor or subcontractor relating to a registration should be directed to.

Director
Home Improvement Contractor Registration
One Ashburton Place, Room 1301
Boston, MA 02108
(617) 727-8598

b. The registration number of the home improvement contractor on the first page of the contract.

c. The owner's three-day cancellation rights under M.G.L. c. 93, § 48; M.G.L. c. 140D, § 10 or M.G.L. c. 255D, § 14, as may be applicable.

d. All warranties and the owner's rights under the provisions of 780 CMR 110.R6 and M.G.L. c. 142A;

e. In ten point bold type or larger, directly above the space provided for the signature, the following statement.

DO NOT SIGN THIS CONTRACT IF THERE ARE ANY BLANK SPACES

f. Whether any lien or security interest is on the residence as a consequence of the contract.

9. An enumeration of such other matters upon which the owner and the contractor may lawfully agree; provided, however that no such agreement may waive any rights conveyed to the owner under the provisions of 780 CMR 110.R6 and M.G.L. c. 142A;

10. Any other provision otherwise required by the applicable laws of the Commonwealth.

110.R6.5.2.2 Permit Notice. Any contract entered into between a home improvement contractor and an owner shall contain a clause informing the owner of the following:

1. Any and all necessary construction-related permits;

2. That it shall be the obligation of the home improvement contractor to obtain such permits as the owner's agent;

3. That owners who secure their own construction-related permits or deal with

unregistered contractors will be excluded from the guaranty fund provisions of M.G.L. c. 142A;

110.R6.5.2.3 Acceleration of Payment. No contract shall contain an acceleration clause under which any part or all of the balance not yet due may be declared due and payable because the holder deems himself to be insecure. However, where the contractor deems himself to be insecure he/she may require as a prerequisite to continuing said work that the balance of funds due under the contract, which are in the possession of the owner, shall be placed in a joint escrow account requiring the signatures of the home improvement contractor and owner for withdrawal.

110.R6.5.2.4 Copy to Owner. At the time of signing, the owner shall be furnished with a copy of the contract signed by both the home improvement contractor and the owner. No work shall begin prior to the signing of the contract and transmittal to the owner of a copy of such contract.

110.R6.5.2.5 Arbitration. Any contract entered into between a home improvement contractor and owner may provide that the home improvement contractor may initiate alternative dispute resolution through any private arbitration services approved by the secretary, as provided in M.G.L. c. 142A; provided, that said alternative dispute resolution provision is clearly and conspicuously disclosed in the contract, in language designated by the secretary, and that each party separately signs and dates the provision, thereby assenting to the procedure. The following language and format is acceptable.

THE CONTRACTOR AND THE HOMEOWNER HEREBY MUTUALLY AGREE IN ADVANCE THAT IN THE EVENT THE CONTRACTOR HAS A DISPUTE CONCERNING THIS CONTRACT, THE CONTRACTOR MAY SUBMIT SUCH DISPUTE TO A PRIVATE ARBITRATION SERVICE WHICH HAS BEEN APPROVED BY THE SECRETARY OF THE OFFICE OF CONSUMER AFFAIRS AND BUSINESS REGULATIONS AND THE CONSUMER SHALL BE REQUIRED TO SUBMIT TO SUCH ARBITRATION AS PROVIDED IN M.G.L. c. 142A.

____
Contractor

____
Owner

NOTICE: THE SIGNATURES OF THE PARTIES ABOVE APPLY ONLY TO THE AGREEMENT OF THE PARTIES TO ALTERNATIVE DISPUTE SETTLEMENT INITIATED BY THE CONTRACTOR. THE OWNER MAY INITIATE ALTERNATIVE DISPUTE RESOLUTION EVEN WHERE THIS SECTION IS NOT SEPARATELY SIGNED BY THE PARTIES.

110.R6.5.3 Dispute Resolution.

110.R6.5.3.1 Court Action. Any party may bring an action to enforce any provisions of 780 CMR 110.R6 and M.G.L. c. 142A, in superior court, the district court, or the small claims division of the district court.

110.R6.5.3.2 Owner Right to Arbitration. In the alternative, an owner may request that a dispute resulting from and relating to residential contracting be decided under the terms of a private arbitration service approved by the secretary.

110.R6.5.3.3 Contractor Right to Arbitration. The home improvement contractor may initiate dispute resolution through private arbitration services approved by the secretary, provided that the contract between the owner and the home improvement contractor contains such a clause as provided in 780 CMR 110.R6.5.2.5.

110.R6.5.4 Validity of Contract. Contracts which fail to comply with the requirements of 780 CMR 110.R6 and M.G.L. c. 142A shall not be invalid solely because of noncompliance.

780 CMR 110.R6.6 SUPPLEMENTARY IDENTIFICATION CARDS

110.R6.6.1 Definitions.

Certificate of Registration. The document issued by the Director showing the registrant's certificate number and other data as required by the director.

Identification Card. The document issued to the responsible individual or to one or more individuals in the employ of the applicant/registrant.

110.R6.6.2 Certificates of Registrants. For applicants registering as individuals, the certificate of registration and identification card will be issued in the name of the registrant. Only one identification card will be issued to individual registrants.

110.R6.6.2.2 Non-individual Registrants.

110.R6.6.2.2.1 If the Applicant is a corporation, partnership, proprietorship with a fictitious name, or other non-individual entity, the certificate of registration and the initial identification card will bear the name of the registrant entity and the individual responsible for the home improvement residential contracting activities of the registrant.

110.R6.6.2.2.2 Supplementary identification cards may be issued, upon request of the registrant, to named officers, partners, of key individuals in the employ of the registrant under the certificate of registration number of the applicant entity, upon submission of the appropriate request form and fee. The applicant is responsible for the prompt return of individual identification cards if there is a change in status of individuals holding such supplementary cards.

110.R6.6.3 Fees. For each additional identification card request in accordance with 780 CMR 110.R6.2.2.1, an additional fee per card in an amount of $10.00 must accompany the request for additional cards.

110.R6.6.4 Expiration. Supplementary cards will expire on the same date as the expiration date of the registrant entity, and must be renewed along with the renewal of the registrant entity's registration by submission of the required application and fee of $10.00 per card requested.

780 CMR 110.R7

CERTIFICATION OF INSPECTORS OF BUILDINGS, BUILDING COMMISSIONERS AND LOCAL INSPECTORS

(Note: This Regulation is unique to Massachusetts)

FORWARD

Contained in 780 CMR R7 are the *rules and regulations* for the certification of all inspectors of buildings, building commissioners and local inspectors (collectively referred to as building code enforcement officials) of the Board of Building Regulations and Standards (BBRS). In accordance with M.G.L. c. 143, §§3 and 94, the BBRS is authorized to adopt rules and regulations which govern the administration of such program..

780 CMR 110.R7.1 General Provisions

110.R7.1.1 Title
110.R7.1.2 Definitions
110.R7.1.3 Scope, intent
110.R7.1.4 Powers and duties
110.R7.1.5 Inspector Certification Advisory Committee (Building Official Certification Committee)
110.R7.1.6 Categories of certification
110.R7.1.7 Certifications required

780 CMR 110.R7.1 General Provisions

110.R7.2 Requirements for Initial Certification
110.R7.2.1 Application
110.R7.2.2 Building Code Enforcement Officials in office as of November 12, 1992
110.R7.2.3 After November 12, 1992
110.R7.2.4 Requirements for certification as a local inspector
110.R7.2.5 Requirements for certification as an inspector of buildings/building commissioner

780 CMR 110.R7.3 Requirements for Maintenance of Certification

110.R7.3.1 Continuing education
110.R7.3.2 Renewal of certification
110.R7.4 Procedures for Complaints
110.R7.4.1 Complaints
110.R7.4.2 Revocation of certificates and alternate sanctions
110.R7.4.3 Violations and penalties

780 CMR 110.R7.1 GENERAL PROVISIONS

110.R7.1.1 Title. 780 CMR 110.R7 entitled *Certification of Inspectors of Buildings, Building Commissioners and Local Inspectors* (hereinafter collectively referred to as Building Code Enforcement Officials) is authorized and promulgated by the State Board of Building Regulations and Standards under the authority of M.G.L. c. 143, §§ 3 and 94.

110.R7.1.2 Definitions. Any terms not herein defined shall assume the definition of the term as used elsewhere in 780 CMR.

BBRS. State Board of Building Regulations and Standards

REGISTRANT. Any individual registered with the Board of Building Regulations and Standards (BBRS) as a building code enforcement official in the capacity of an inspector of buildings/building commissioner or local inspector.

110.R7.1.3 Scope, Intent. 780 CMR 110.R7 shall control all matters relating to qualifications and certification of all building code enforcement officials engaged in or to be engaged in the administration and enforcement of 780 CMR; categories of certified building code enforcement officials; procedures for application, issuance, denial and revocation of certifications; approval of training and/or educational programs offered to meet the requirements for certification; maintenance of certification through continuing education; application fees for certification; and enforcement of 780 CMR 110.R7.

It is the purpose of 780 CMR 110.R7 to establish standards and procedures for certification, and to require all persons performing duties with respect to the inspection of building construction for any political subdivision within the Commonwealth to be certified as provided in 780 CMR 110.R7.

110.R7.1.4 Powers and Duties. The BBRS, working through the Administrator and the Board staff, shall have the following responsibilities in addition to all others provided in 780 CMR and 780 CMR 110.R7.

110.R7.1.4.1. Upon recommendations from the Building Official Certification Committee, established under 780 CMR 110.R7.1.5, to issue certifications to individuals deemed qualified as provided for herein.

110.R7.1.4.2. To maintain accurate records of all applications for certification and any official action thereon and to make such records available for inspection by the public at all reasonable times.

110.R7.1.4.3. To suspend or revoke a certification provided for herein upon the establishment of good cause as defined by 780 CMR 110.R7.4.2.

110.R7.1.4.4. Any person aggrieved by any notice, action, ruling or order of the Board, or the Building Official Certification Committee with respect to 780 CMR 110.R7, may have a right to a hearing as provided for by law.

110.R7.1.5 Inspector Certification Advisory Committee (Building Official Certification Committee):

110.R7.1.5.1. There is hereby established in the BBRS the Inspector Certification Advisory Committee hereafter known as the *Building Official Certification Committee*. This Committee shall be supported by such staff of the BBRS as may be required for the effective operation of 780 CMR 110.R7.

110.R7.1.5.2 Powers and Duties. The Building Official Certification Committee shall have the responsibility to advise and to recommend to the BBRS on all items relating to the certification of building code enforcement officials, including, but not limited to:

1. Issuing certificates
2. Reviewing applicant credentials
3. Maintaining applicant and certified inspector records
4. Hearing complaints and appeals pertaining to inspector certification
5. Reviewing and approving all courses of study, seminars, and other educational programs as deemed necessary, for continuing education requirements.
6. Monitoring all appointments to assure compliance with 780 CMR 110.R7.
7. Considering reciprocity with other states (upon petition of the Building Official Certification Committee on forms provided for such purpose).

110.R7.1.5.3 Make-up of the Committee. The Building Official Certification Committee shall consist of nine members appointed by the BBRS as follows: (Terms of committee members are as established by lot at the March 31, 1993 meeting.)

1. One member of the BBRS or his or her designee
2. Six members who are active building officials consisting of:
   a. One member from each of the three Municipal Building Official's Associations (Southeastern Building Officials Association, Building Officials of Western Massachusetts, Massachusetts Building Commissioners and Inspectors Association).
   b. Three members at large to be appointed by the BBRS.
3. One member from academia who is an educator of construction at the college level (e.g. architectural, civil, structural) to be appointed by the BBRS.
4. One member of the Massachusetts Municipal Association.

110.R7.1.6 Categories of Certification.

110.R7.1.6.1. Categories of certification for building code enforcement officials are as follows:

110.R7.1.6.1.1 Inspector of Buildings or Building Commissioner. An individual certified as an inspector of buildings/building commissioner shall perform the duties as defined in 780 CMR 106 of the *Sixth Edition of the Massachusetts State Building Code*, 780 CMR 5106 and M.G.L. c. 143, as applicable.

110.R7.1.6.1.2 Local Inspector. An individual certified as a local inspector shall perform the duties as defined in 780 CMR 106 of the *Sixth Edition of the Massachusetts State Building Code*, 780 CMR 5106 and M.G.L. c. 143, as applicable.

110.R7.1.6.1.3 Conditional Appointment of a Building Code Enforcement Official. A conditional appointee shall meet the requirements of 780 CMR 110.R7.1.7.4 through 780 CMR 110.1.7.6.3.

110.R7.1.6.1.4 Alternate Inspectors of Buildings/Building Commissioners. An alternate inspector of buildings/building commissioner shall be certified prior to appointment.

110.R7.1.7 Certifications Required.

110.R7.1.7.1. After November 12, 1992, no individual shall be permanently appointed to the position of inspector of buildings, building commissioner or local inspector in a municipal enforcing agency for which a certification requirement has been established by 780 CMR 110.R7, unless that individual has been deemed qualified and certified in that category by the Building Official Certification Committee.

110.R7.1.7.1.1 Conditional Appointments. Conditional appointments may be made pursuant to 780 CMR 110.R7.1.7.4, 1.7.5 and 1.7.6.

110.R7.1.7.2 Reporting by Appointing Authorities. Immediately following appointment, the clerk of each city or town shall report to the BBRS, the name, title and status of each new employee who is appointed as an inspector of buildings, building commissioner or local inspector. Said report shall be provided on forms as prescribed by the BBRS for said purpose and shall be submitted in attestation under the pains and penalties of perjury that said new employee meets or exceeds the minimum qualifications as defined by M.G.L. c. 143, § 3 and 780 CMR 105.3, 105.4 of the *Sixth Edition of the Massachusetts State Building Code*, 780 CMR 5105.3 and 5105.4, as applicable.

110.R7.1.7.3 Historical Note. Any individual employed as inspector of buildings, building commissioner or local inspector and who was in office on November 12, 1992 and who was qualified (in accordance with M.G.L. c. 143, § 3) to be in office at time of hire, and who presented acceptable evidence of these facts to the BBRS, shall be deemed certified in the category held on said date, and shall be provided with a certificate by the BBRS.

110.R7.1.7.4 Conditional Appointments. After November 12, 1992, individuals who meet or exceed the experience requirements pursuant to M.G.L. c. 143, § 3 and 780 CMR, but who are not certified under the provisions of 780 CMR 110.R7 may be appointed on a conditional basis only.

110.R7.1.7.5 Regulations for the conditional appointment of Building Code Enforcement Officials.

110.R7.1.7.5.1. Any individual conditionally appointed as a building code enforcement official, on or after November 12, 1992 who is not certified in the appropriate category at the time of the conditional appointment; shall comply with the following:

1. Immediately upon appointment, the city or town clerk shall report the conditional appointment to the BBRS in accordance with 780 CMR 110.R7.1.7.2.
2. Within the first six months of employment the conditional appointee shall make application to take the examination(s) required for the appropriate category of certification as identified in 780 CMR 110.R7.2.0.
3. Within one year following the first six months of employment a conditional appointee who is appointed as an inspector of buildings\building commissioner shall attain a passing score on all of the examinations required for that category of certification.
4. Within six months following the first six months of employment a conditional appointee who is appointed as a local inspector shall attain a passing score on all of the examinations required for that category of certification.
5. In accordance with 780 CMR 110.R7.1.7.6, a conditional appointee may petition the Building Official Certification Committee in writing for an extension of time to comply with the examination schedule of 780 CMR 110.R7. Upon establishment of cause, the Building Official Certification Committee may grant such extensions of time as it may consider appropriate as detailed in 780 CMR 110.R7.1.7.6.

110.R7.1.7.5.2. Conditional appointees shall notify the BBRS of any change in the status of their employment, within one month of such change.

110.R7.1.7.6 Requests for Extensions of Time to Comply with Examination Schedules.

110.R7.1.7.6.1. Upon written petition to the Building Official Certification Committee, any conditional appointee unable to comply with the examination schedule as cited in 780 CMR 110.R7.1.7.5 may for cause, be granted an extension of time in order to comply. Petitions shall be forwarded to the clerk of said committee on forms for such purpose, and addressed to the office of the BBRS. The conditional appointee shall state all reasons to substantiate the request for an extension of time. Conditional appointees who have not attempted the examination schedule as herein defined during the prescribed period shall not be granted an extension, and no conditional appointee shall be afforded more than three extensions of time beyond the prescribed period for the level of certification sought.

110.R7.1.7.6.2. The Building Official Certification Committee shall, within ten days of any action taken by the committee pursuant to 780 CMR 110.R7, notify the appointing authority in writing of such action.

780 CMR R7.2 REQUIREMENTS FOR INITIAL CERTIFICATION

110.R7.2.1 Application. Any candidate for certification in any category of building code enforcement official issued pursuant to 780 CMR 110.R7 shall submit an application to the BBRS, accompanied by the required application fee (if any), on forms provided for this purpose by the BBRS. The application shall include such information and documentation as the BBRS may require pursuant to 780 CMR 110.R7.

110.R7.2.2 Building Code Enforcement Officials in Office as of November 12, 1992 (Historical Note). Upon receipt of acceptable evidence as established by the BBRS, signed by the city or town clerk and the appointing authority in attestation that the applicant for certification was employed in the position of inspector of buildings, building commissioner or local inspector and met the qualification requirements of said position pursuant to M.G.L. c. 143, § 3 and 780 CMR as of the date of hire, the applicant shall be deemed certified in the applicable category and shall be issued a certificate. The certificate shall indicate the name of the individual and the category of certification and other information as may be deemed necessary by the BBRS.

110.R7.2.3. After November 12, 1992, applicants for certification as a Building Code Enforcement Official shall meet the requirements of 780 CMR 110.R7.2.4

110.R7.2.4 Requirements for Certification as a Local Inspector:

110.R7.2.4.1 All candidates shall meet or exceed the qualifications for the position of local inspector pursuant to M.G.L. c. 143, § 3 and 780 CMR prior to taking any examinations. The Board of Building Regulations via the certification committee shall approve all candidates prior to taking any examinations. The certification committee shall maintain a list of all qualified candidates for any and all city and towns appointing building officials.

110.R7.2.4.2. All candidates shall attain a passing score in all examinations required for certification as either a Building Plans Examiner (identified as Exams 1B, 1C, 3B and 3C) or Building Inspector (identified as Exams 1A, 1B and 3B) as defined by the National Certification Program for Construction Code Inspectors (NCPCCI) or equivalent exam categories as approved by the BBRS for such purpose and as offered by the International Code Council (ICC).

110.R7.2.4.3 Prior approval for examination as a Local Inspector. No candidates shall be allowed to take said examinations without prior approval of the Board of Building Regulations and Standards or the certification committee at the Board's discretion.

110.R7.2.5 Requirements for Certification as an Inspector of Buildings/Building Commissioner.

110.R7.2.5.1. All candidates shall meet or exceed the qualifications for the position of inspector of buildings\building commissioner pursuant to M.G.L. c. 143, § 3 and 780 CMR prior to any examinations. The Board of Building Regulations and Standards via the certification committee shall approve all candidates prior to taking any examinations. The certification committee shall maintain a list of all qualified candidates for any and all city and towns appointing building officials.

110.R7.2.5.2. All candidates shall meet the examination requirements for certification as a local inspector pursuant to 780 CMR 110.R7.2.4.2, or hold a certification as a local inspector pursuant to 780 CMR 110.R7.2.2.

110.R7.2.5.3. All candidates shall attain passing scores in all examinations required for certification as a Certified Building Official as defined by the Certified Building Official Program of the Council of American Building Officials (CAB O) or equivalent exam categories as approved by the BBRS for such purpose and as offered by the International Code Council (ICC).

110.R7.2.5.4 Prior Approval for Examination as an Inspector of Buildings/Building Commissioner. No candidates shall be allowed to take said examinations without prior approval of the Board of Building Regulations and Standards or the certification committee at the Board's discretion.

110.R7.2.6 Retired Persons. Any person who has been duly certified in accordance with 780 CMR 110.R7 and who retires from service in good standing, may petition the committee to receive "retired status" certification. Upon approval said certification shall be denoted "retired" and shall not be deemed revoked. Revocation shall only be invoked for cause. Any person who has been approved for "retired status" certification and who wishes to reactivate said certification shall comply with the examination schedule as defined in 780 CMR 110.R7 for the level of certification sought.

780 CMR 110.7.3 REQUIREMENTS FOR MAINTENANCE OF CERTIFICATION STATUS

110.R7.3.1 Continuing Education.

110.R7.3.1.1. Within each three year period following initial certification, the registrant shall complete 45 hours of continuing education credit acceptable to the Building Official Certification Committee. Conditional appointees as defined by 780 CMR 110.R7 shall attain at least one contact hour of education credit for each month of employment until such time as the conditional appointee has successfully completed the required examination schedule and is certified as prescribed.

110.R7.3.1.2. The Committee may publish a list of acceptable educational programs, courses, seminars, and the like. The Committee may also accept educational activities in which registrants have participated after the fact, upon application and review of the course information. The Committee shall assign credits to each educational/training event. The Committee shall issue policies and procedures, separate from 780 CMR 110.R7 relative continuing education requirements.

110.7.3.2 Renewal of Certificate.

110.R7.3.2.1 Term of Certificate. Each certified individual shall maintain a record of his/her continuing education. Credit hours shall be reported to the BBRS or other approved agencies as prescribed by the Committee's policies and procedures relative to continuing education. The BBRS shall maintain a record of each inspector's progress.

At the end of each three year period, each inspector who has successfully maintained his/her continuing education credit shall be duly notified by the BBRS.

110.R7.3.3. In accordance with M.G.L. c. 143, § 99, no building code enforcement official attending BBRS required educational programs, shall lose any rights relative to compensation or vacation.

780 CMR 110.R7.4 PROCEDURES FOR COMPLAINTS

110.R7.4.1 Complaints.

110.R7.4.1.1 Cause for Complaint. Any registrant who has been judged to have violated the provisions of 780 CMR 110.R7 or 780 CMR by a competent court having jurisdiction or has been judged to have violated procedures as defined by the State Ethics Commission for acts pertinent to his\her performance as a certified building code enforcement official may be entitled to a hearing in accordance with M.G.L. c. 30A before the Building Official Certification Committee or subcommittee thereof in respect to retention of his\her certification.

Exception: The BBRS and\or members of the Building Official Certification Committee or sub-committee thereof, may convene hearings for those registrants who fail to attain continuing education credits as defined by 780 CMR 110.R7.7.3.

110.R7.4.1.2 Hearings on Complaints. If a hearing is to convene, the committee shall give at least ten days notice to all those party to the complaint. The sending of notice to the address recorded on the records of the BBRS shall be deemed sufficient notice.

110.R7.4.1.3 Notice of Hearings. The notice shall contain:

1. The name of the complainant
2. A copy of the complaint
3. The date, time and place of said hearing.

The complete file of complaint shall be available for inspection at the office of the BBRS during regular business hours. Parties may present written or oral evidence to refute or mitigate any charge contained in the complaint and present witnesses in his or her behalf. In the event that the committee votes to take action against said certification pursuant to this hearing, the building code enforcement official, upon notice of the decision, shall immediately comply with said action.

110.R7.4.1.4 Continuation of Hearings. the committee, in its discretion, may continue the date for hearing upon request by building official, the complainant or the committee itself.

110.R7.4.1.5 Timing of Decisions. The committee shall make a decision within 15 days of the hearing. A written decision shall be issued within 30 days of the hearing date.

110.R7.4.1.6 Decisions. The decision shall be final and binding upon the building code enforcement official and the complainant.

110.R7.4.1.7 Notice of Action. In the event that the committee votes to take action against said certification pursuant to this hearing, the building code enforcement official, upon notice of the decision, shall immediately comply with said action.

110.R7.4.1.8 Appeal. Any person aggrieved by a decision of the committee may appeal such decision to a court of law or equity in conformance with M.G.L. c. 30A, § 14.

110.R7.4.2 Revocation of Certificates and Alternative Sanctions.

110.R7.4.2.1. The BBRS, upon recommendation of the Committee, and subject to the requirements of Administrative Practices as defined by M.G.L. c. 30A, may suspend or revoke a certification, or assess any other penalties as provided for by law, if it is determined that the registrant: (The following is not an exhaustive list.)

1. Has obtained a certification by fraud or misrepresentation, or the person named in the certificate has obtained it by fraud or misrepresentation as judged by members of the Building Official Certification Committee following a hearing on such matters;
2. Has aided or abetted in practice as a certified building code enforcement official any person not authorized to practice as a certified building code enforcement official under the provisions of 780 CMR 110.R7 as judged by members of the Building Official Certification Committee following a hearing on such matters;
3. Has fraudulently or deceitfully practiced as a certified building code enforcement official as judged by the State Ethics Commission and/or a competent court having jurisdiction and following a hearing before members of the Building Official Certification Committee on such matters;
4. Has been grossly negligent or has engaged in misconduct in the performance of any of his or her duties as judged by the State Ethics Commission and/or a competent court having jurisdiction and following a hearing before members of the Building Official Certification Committee on such matters;
5. Has failed, over a period of time, to maintain continuing education requirements as specified in 780 CMR 110.R7 as judged by members of the Building Official Certification Committee following a hearing on such matters;
6. Has been found to have failed to report an offer, or bribe, or other favor in a proceeding under 780 CMR 110.R7 or other appropriate law of this or any other state or jurisdiction as judged by the State Ethics Commission and\or a competent court having jurisdiction and following a hearing before members of the Building Official Certification Committee on such matters;

7. Has made a false or misleading statement, or has made a material omission in any submission to the BBRS as judged by members of the Building Official Certification Committee following a hearing on such matters;

8. Has failed to enforce the provisions of 780 CMR as prescribed by M.G.L. c. 143, § 3 as judged by the State Ethics Commission and/or a competent court having jurisdiction and following a hearing before members of the Building Official Certification Committee on such matters.

110.R7.4.3 Violations and Penalties.

110.R7.4.3.1. It shall be a violation of 780 CMR 110.R7 on or after November 12, 1992, for any individual to represent himself or herself to be qualified for a position that the individual does not currently hold, or to use a title or otherwise represent himself or herself to be qualified for a position that the individual does not currently hold, or to use a title or otherwise represent himself or herself as certified or authorized to act under the 780 CMR if that individual does not possess a certificate, unless such person is appointed subject to the provisions of 780 CMR 110.R7.1.6.1.3. In addition to any other remedy available under law, such representation shall be deemed a violation of 780 CMR 110.R7 and any other penalties as provided for by law.

110 R7.4.3.2. It shall be a violation of 780 CMR 110.R7 on and after November 12, 1992, for any local enforcing agency to offer employment, to retain for employment or to permanently appoint any individual who is not certified in accordance 780 CMR 110.R7, except on a conditional basis in accordance with 780 CMR 110.R7.1.6.1.3.

110.R7.4.3.3. No person whose certification has been revoked in accordance with procedures established by 780 CMR 110.R7 shall approach the Board for certification or re-certification until a period of at least one year has elapsed from the date of revocation. (The date of revocation shall be defined as the date that appears on the written decision relating to the case.) Any person applying for certification or recertification under these procedures shall be viewed as a first time candidate for certification and shall meet or exceed all applicable requirements of 780 CMR, 780CMR 110.R7 and Massachusetts General Law pertaining to the certification process; including but not limited to minimum qualifications defined for the positions of inspector of buildings building commissioner and local inspector. In addition no person whose certification has been revoked in accordance with procedures established by 780CMR 110.R7 shall approach the Board for certification or recertification without first complying with the examination schedule as herein defined in 780 CMR 110.R7 for the level of certification sought. Upon review of the matter by members of the BBRS and\or members of the Building Official Certification Committee, certification may be issued or reissued. However, the Board may permanently revoke a certification, for cause.

(780 CMR 111.00 THROUGH 119.00: RESERVED)

(PAGES 975 THROUGH 980 ARE RESERVED FOR FUTURE USE.)

Part XII — Appendices

780 CMR 120.00

780 CMR 120.A

EMPLOYEE QUALIFICATIONS

(Note: *780 CMR 120.A is unique to Massachusetts*)

780 CMR 120.A101 BUILDING OFFICIAL QUALIFICATIONS.

120.A101.1 Inspector of Buildings/Building Commissioner. The requirements/qualifications for the inspector of buildings/building commissioner are set forth in M.G.L. c. 143, § 3, supplemented by 780 CMR 110.R7

120.A101.2 Building Inspector. The requirements/qualifications for the building inspector are set forth in M.G.L. c. 143, § 3, supplemented by 780 CMR 110.R7.

NON-TEXT PAGE

780 CMR 120.B

BOARD OF APPEALS

(Note: *780 CMR 120.B is unique to Massachusetts*)

780 CMR 120.B101 GENERAL

120.B101.1 Scope. Refer to M.G.L. c. 143, § 100 and 780 CMR 122.0 or 780 CMR 5122.0, as applicable, for requirements regarding appealing the interpretation, order, requirement, direction or failure to act by any state or local agency or any person or state or local agency charged with the administration or enforcement of the state building code or any of its rules and regulations, except for the specialized codes as described in M.G.L. c. 143, § 96.

NON-TEXT PAGE

780 CMR 120.C

GROUP U AGRICULTURAL BUILDINGS

780 CMR 120.C101 GENERAL

120.C101.1 Scope. The provisions of 780 CMR 120.C shall apply exclusively to agricultural buildings. Such buildings shall be classified as Group U and shall include the following uses:

1. Livestock shelters or buildings, including shade structures and milking barns.
2. Poultry buildings or shelters.
3. Barns.
4. Storage of equipment and machinery used exclusively in agriculture.
5. Horticultural structures, including detached production greenhouses and crop protection shelters.
6. Sheds.
7. Grain silos.
8. Stables.

780 CMR 120.C102 ALLOWABLE HEIGHT AND AREA

120.C102.1 General. Buildings classified as Group U Agricultural shall not exceed the area or height limits specified in Table 120.C102.1.

120.C102.2 One-story Unlimited Area. The area of a one-story Group U agricultural building shall not be limited if the building is surrounded and adjoined by public ways or yards not less than 60 feet (18288 mm) in width.

780 CMR 120.C103 MIXED OCCUPANCIES

120.c103.1 Mixed Occupancies. Mixed occupancies shall be protected in accordance with 780 CMR 3.00.

780 CMR 120.C104 EXITS

120.C104.1 Exit Facilities. Exits shall be provided in accordance with 780 CMR 10.00 and 11.00.

Exceptions:

1. The maximum travel distance from any point in the building to an approved exit shall not exceed 300 feet (91440 mm).
2. One exit is required for each 15,000 square feet (1393.5 m^2) of area or fraction thereof.

TABLE 120.C102.1 – BASIC ALLOWABLE AREA FOR GROUP U, ONE STORY IN HEIGHT AND MAXIMUM HEIGHT OF SUCH OCCUPANCY

I		II		III and IV		V	
A	B	A	B	IIIA and IV	IIIB	A	B
ALLOWABLE AREA (square feet)[a]							
Unlimited	60,000	27,100	18,000	27,100	18,000	21,100	12,000
MAXIMUM HEIGHT IN STORIES							
Unlimited	12	4	2	4	2	3	2
MAXIMUM HEIGHT IN FEET							
Unlimited	160	65	55	65	55	50	40

For SI: 1 square foot = 0.0929 m^2

a. See 780 CMR 120.C102 for unlimited area under certain conditions.

NON-TEXT PAGE

780 CMR 120.D

RESERVED

NON-TEXT PAGE

780 CMR 120.E

SUPPLEMENTARY ACCESSIBILITY REQUIREMENTS

(Note: *780 CMR 120.E is unique to Massachusetts*)

780 CMR 120.E101 GENERAL

120.E101.1 Scope. For conformance to Massachusetts accessibility requirements refer to 521 CMR and 780 CMR 1007.

NON-TEXT PAGE

780 CMR 120.F

RODENT PROOFING

780 CMR 120.F101 GENERAL

120.F101.1 General. Buildings or structures and the walls enclosing habitable or occupiable rooms and spaces in which persons live, sleep or work, or in which feed, food or foodstuffs are stored, prepared, processed, served or sold, shall be constructed in accordance with the provisions of 780 CMR 120.F101.

120.F101.2 Foundation Wall Ventilation Openings. Foundation wall ventilator openings shall be covered for their height and width with perforated sheet metal plates no less than 0.070 inch (1.8 mm) thick, expanded sheet metal plates not less than 0.047 inch (1.2 mm) thick, cast iron grills or grating, extruded aluminum load-bearing vents or with hardware cloth of 0.035 inch (0.89 mm) wire or heavier. The openings therein shall not exceed ¼ inch (6.4 mm).

120.F101.3 Foundation and Exterior Wall Sealing. Annular spaces around pipes, electric cables, conduits, or other openings in the walls shall be protected against the passage of rodents by closing such openings with cement mortar, concrete masonry or noncorrosive metal.

120.F101.4 Doors. Doors on which metal protection has been applied shall be hinged so as to be free swinging. When closed, the maximum clearance between any door, door jambs and sills shall not be greater than ⅜ inch (9.5 mm).

120.F101.5 Windows and Other Openings. Windows and other openings for the purpose of light or ventilation located in exterior walls within two feet (610 mm) above the existing ground level immediately below such opening shall be covered for their entire height and width, including frame, with hardware cloth of at least 0.035 inch (0.89 mm) wire or heavier.

Note: For emergency escape windows, all screens and any security grid systems shall conform to the requirements of 780 CMR, 527 CMR (the State Fire Code) and the 105 CMR (State Sanitary Code) as applicable and such that emergency escape or fire department rescue efforts are not hindered.

120.F101.5.1 Rodent-accessible Openings. Windows and other openings for the purpose of light and ventilation in the exterior walls not covered in this chapter, accessible to rodents by way of exposed pipes, wires, conduits and other appurtenances, shall be covered with wire cloth of at least 0.035 inch (0.89 mm) wire. In lieu of wire cloth covering, said pipes, wires, conduits and other appurtenances shall be blocked from rodent usage by installing solid sheet metal guards 0.024 inch (0.61 mm) thick or heavier. Guards shall be fitted around pipes, wires, conduits or other appurtenances. In addition, they shall be fastened securely to and shall extend perpendicularly from the exterior wall for a minimum distance of 12 inches (305 mm) beyond and on either side of pipes, wires, conduits or appurtenances.

120.F101.6 Pier and Wood Construction.

120.F101.6.1 Sill less than 12 Inches above Ground. Buildings not provided with a continuous foundation shall be provided with protection against rodents at grade by providing either an apron in accordance with 780 CMR 120.F101.6.1.1 or a floor slab in accordance with 780 CMR 120.F101.6.1.2.

120.F101.6.1.1 Apron. Where an apron is provided, the apron shall not be less than eight inches (203 mm) above, nor less than 24 inches (610 mm) below, grade. The apron shall not terminate below the lower edge of the siding material. The apron shall be constructed of an approved nondecayable, water-resistant ratproofing material of required strength and shall be installed around the entire perimeter of the building. Where constructed of masonry or concrete materials, the apron shall not be less than 4 inches (102 mm) in thickness.

120.F101.6.1.2 Grade Floors. Where continuous concrete grade floor slabs are provided, open spaces shall not be left between the slab and walls, and openings in the slab shall be protected.

120.F101.6.2 Sill at or above 12 Inches above Ground. Buildings not provided with a continuous foundation and which have sills 12 or more inches (305 mm) above the ground level shall be provide with protection against rodents at grade in accordance with any of the following:

1. 780 CMR 120.F101.6.1.1 or 120.F101.6.1.2;
2. By installing solid sheet metal collars at least 0.024 inch (0.6 mm) thick at the top of each pier or pile and around each pipe, cable, conduit, wire or other item which provides a continuous pathway from the ground to the floor; or
3. By encasing the pipes, cables, conduits or wires in an enclosure constructed in accordance with 780 CMR 120.F101.6.1.1.

NON-TEXT PAGE

780 CMR 120.G

FLOOD RESISTANT CONSTRUCTION AND CONSTRUCTION IN COASTAL DUNES

(Note: *780 CMR 120.G is unique to Massachusetts*)

780 CMR 120.G101 GENERAL

120.G101.1 General: All buildings and structures erected in areas prone to flooding and/or coastal dunes shall be constructed and elevated as required by the provisions of 780 CMR 120.G.

780 CMR 120.G201 DEFINITIONS

120.G201.1 Definitions. The following words and terms shall, for the purposes of 780 CMR 120.G, and as used elsewhere in 780 CMR, have the meanings shown in 780 CMR 120.G201.

A-Zones: A Zones are synonymous with Flood–Hazard Zones.

Base Flood Elevation: The flood having a 1% chance of being equaled or exceeded in any given year and shall be used to define areas prone to flooding, and describe at a minimum, the depth or peak elevation of flooding.

Basement/Cellar: Any area of the building having its floor subgrade (below ground level) on all sides.

Breakaway Wall: A wall that is not part of the structural support of the building and intended, through its design and construction, to collapse under specific lateral loading forces, without causing damage to the elevated portion of the building or supporting foundation system.

Coastal Dune: Any natural hill, mound or ridge of sediment landward of a coastal beach deposited by wind action or storm overwash. Coastal Dune also means sediment deposited by artificial means and serving the purpose of storm damage prevention or flood control.

Coastal Wetland Resource Area: Any coastal wetland resource area subject to protection under M.G.L. c. 131, § 40 (the Wetlands Protection Act), and 310 CMR 10.21 through 10.35: *Coastal Wetlands*. Coastal Wetland Resource Areas include barrier beaches, coastal beaches, coastal dunes, rocky intertidal shores, tidal flats, land subject to 100 year coastal storm flowage, coastal banks, land containing shellfish, lands subject to tidal action, and lands under an estuary, salt pond or certain streams, ponds, rivers, lakes or creeks within the coastal zone that are anadromous/ catadromous fish runs.

Conservation Commission: Body comprised of members lawfully appointed pursuant to M.G.L. c. 40, § 8C. It shall also mean a mayor or board of selectmen, where no conservation commission has been established pursuant to M.G.L. c. 40, § 8C.

Determination of Applicability: A written finding by the issuing authority under M.G.L. c. 131, § 40 (the Wetlands Protection Act), as to whether a site or the work proposed therein is subject to jurisdiction under M.G.L. c. 131, § 40.

Elevation: The placement of a structure above flood level to minimize or prevent flood damages or to preserve the flood control and storm damage prevention functions of a coastal dune.

Failure of a Foundation: a foundation that is no longer supporting the building or foundation or is determined by the building official to be unsafe or incapable of continuing to support the building. For example, failure of a foundation occurs when a building or structure or portion thereof falls off the foundation or when the building official determines there is a risk that the building or structure may fall off the foundation.

Flood- Hazard Zones: Areas subject to a 1% or greater chance of flooding in any given year and that are not subject to wave heights in excess of three feet. (A ZONES).

Floodproofing: Any combination of structural and non-structural additions, changes or adjustments to structures which reduce or eliminate flood damage to new or substantially improved structures.

F.E.M.A.: Federal Emergency Management Agency.

Flood Insurance Rate Map: Flood insurance rate map (FIRM) means an official map of a community, which delineates both the special hazard zones and the risk premium zones applicable to the community.

High-hazard Zones (V Zones): Areas of tidal influence which have been determined to be subject to wave run heights in excess of three feet or subject to high-velocity wave run-up or wave-induced erosion (V Zones).

Highest Adjacent Grade: The highest natural elevation of the ground surface, prior to construction, adjoining the proposed foundation walls of a structure.

Impact Loads: Loads induced by the collision of solid objects on a structure carried by floodwater.

Interests Identified in M.G.L. c. 131, § 40 (the Wetlands Protection Act),: Public or private ground water supply, flood control, storm damage prevention, prevention of pollution, protection of land containing shellfish, protection of fisheries, and protection of wildlife habitat.

Issuing Authority under M.G.L. c. 131, § 40 (the Wetlands Protection Act): a conservation commission, mayor, the selectmen or the Department of Environmental Protection.

Lateral Addition: an addition that expands the footprint of a building or structure including a manufactured home.

Lowest Floor: The lowest floor of the lowest enclosed area (including basement/cellar). An unfinished or flood resistant enclosure, usable solely for parking of vehicles, building access, or incidental storage in an area other than a basement/cellar with appropriate hydrostatic openings as required in 780 CMR 120.G501.4 is not considered a building's lowest floor.

Manufactured Home: A structure that is transportable in one or more sections, built on a permanent chassis, designed for use with or without a permanent foundation when attached to the required utilities, and constructed to the Federal Mobile Home Construction and Safety Standards and rules and regulations promulgated by the U.S. Department of Housing and Urban Development. The term also includes mobile homes, park trailers, travel trailers and similar transportable structures that are placed on a site for 180 days or longer. The term " manufactured home" does not include a "recreational vehicle".

Manufactured Housing: Manufactured Housing is synonymous with Manufactured Home.

Notification of Non-significance: A written finding by the issuing authority under M.G.L. c. 131, § 40 (the Wetlands Protection Act), that the area on which the proposed work is to be done or which the proposed work will alter is not significant to any of the interests identified in M.G.L. c. 131, § 40.

Order of Conditions: Written requirements by the issuing authority under M.G.L. c. 131, § 40 (the Wetlands Protection Act) establishing the manner in which work shall be done for work proposed within areas subject to jurisdiction under M.G.L. c. 131, § 40.

Order of Resource Area Delineation: Written findings by the issuing authority under M.G.L. c. 131, § 40 (the Wetlands Protection Act) identifying the boundaries of the area(s) subject to jurisdiction under M.G.L. c. 131, § 40.

Recreational Vehicle: A vehicle that is built on a single chassis 400 square feet or less when measured at the largest horizontal projection, designed to be self-propelled or permanently towable by a light duty truck, and designed primarily not for use as a permanent dwelling, but as temporary living quarters for recreational, camping, travel or seasonal use. A recreational vehicle is ready for highway use, if it is on wheels or a jacking system, is attached to the site only by quick disconnect type utilities and security devices, and has no permanently attached additions.

Scouring: The erosion or washing away of slopes or soil by velocity waters.

Special Hazard Zones: An area having special flood, and/or flood-related erosion hazards and shown on Flood Hazard Boundary Map or FIRM as Zone A, AO, A1-30, AE, A99, AH, VO, V1-30, VE, V.

Start of Construction: The date the building permit was issued, provided the actual start of construction, repair, reconstruction, placement, or other improvement was within 180 days of the permit date. The actual start means the first placement of permanent construction of a structure on a site, such as the pouring of slab or footings, the installation of piles, the construction of columns, or any work beyond the stage of excavation or the placement of a manufactured home on a foundation.

Structure (this definition is intended utilized with this 780 CMR 120.G): A walled and roofed building, including a gas or liquid storage tank, that is principally above ground and affixed to a permanent site, as well as a manufactured home.

Substantial Damage: Damage of any origin sustained by a building or structure including a manufactured home whereby the cost or restoring the building or structure to its before damaged condition would equal or exceed 50% of the market value of the building or structure before the damage occurred.

Substantial Improvements: Substantial improvement means any reconstruction, rehabilitation, addition, repair or improvement of a structure, the cost of which equals or exceeds 50% of the market value of the structure before the "start of construction" of the improvement. This term includes structures which have incurred "Substantial damage", regardless of the actual repair work performed. Substantial improvement does not, however, include either:

1. any project for improvement of a structure to correct existing violations of state or local health, sanitary, or safety codes which have been identified by the local code enforcement official and which are the minimum necessary to assure safe living conditions or
2. any alteration of a "Historic structure", provided that the alteration will not preclude

the structure's continued designation as a "historic structure."

> **Note 1**: The following items can be excluded from the cost of improvement or repair: plans, specifications, survey, permits, and other items which are separate from or incidental to the repair of the damaged or improved building, *i.e.* debris removal/ cartage.
>
> **Note 2**: The latest Assessors' structure value may be used, provided that the Assessors certify that said value is based on 100% valuation, less depreciation.

Substantial Repair of a Foundation: Work to repair and/or replace a foundation that results in the repair or replacement of the portion of the foundation walls with a perimeter along the base of the foundation that equals or exceeds 50% of the perimeter of the base of the entire foundation measured in linear feet. The term "substantial repair of a foundation" also includes a building or structure including a manufactured home that has incurred a failure of a foundation regardless of the actual work done to repair or replace the foundation.

V Zones: V Zones are synonymous with High-Hazard Zones.

Variance: A grant of relief by a community and the Commonwealth, via the Boards of Appeal, from the terms of the Floodplain Management Regulations.

Venting: A system designed to allow flood waters to enter an enclosure, usually the interior of foundations walls, so that the rising water does not create a dangerous differential in hydrostatic pressure; usually achieved through openings in the walls. Vents may be installed in garage doors to satisfy this requirement, provided such vents are installed consistent with 780 CMR 120.G. The necessity of human intervention, such as opening garage doors, does not satisfy this requirement.

780 CMR 120.G301 BASE FLOOD ELEVATION

120.G301.1 Base Flood Elevation. The base flood elevation shall be used to define areas prone to flooding, and shall describe, at a minimum, the depth or peak elevation of flooding (including wave height) which has a 1% (100-year flood) or greater chance of occurring in any given year

The 100-year flood elevation shall be determined as follows:

1. In A1-30, AH, AE, V1-30 and VE, the Base Flood Elevation is provided on the community's Flood Insurance Study and the Flood Insurance Rate Map (FIRM).
2. In AO zones, add the depth provided on the Flood Insurance Rate Map to the highest adjacent grade. If no depth is provided, add at least two feet to the highest adjacent grade.
3. In A, A99 and V zones, the building official, design professional, or surveyor shall obtain, review and reasonably utilize any Base Flood Elevation Data available from a federal, state or other reliable sources.

780 CMR 120.G401 HAZARD ZONES

120.G401.1 Hazard Zones. Areas which have been determined to have a 1% or greater chance of flooding in any given year shall be classified as either flood-hazard zones (A Zones) or high-hazard zones (V Zones) in accordance with 780 CMR 120.G501 and 120.G601.

780 CMR 120.G501 FLOOD HAZARD ZONES

120.G501.1 Construction in Flood-hazard zones (A Zones). All areas which have a 1% or greater chance of flooding in any given year but are not subject to wave heights in excess of three feet shall be designated as flood-hazard zones. Flood- hazard zones shall include all areas shown as A Zones on the most recent Flood Hazard Boundary Map or FIRM. All buildings and structures as defined in 780 CMR 120.G201 including new or replacement manufactured homes erected or substantially improved in flood-hazard zones shall be designed and constructed in accordance with 780 CMR 120.G501.

Plans for the construction or substantial improvement of a building or structure, including a new or replacement manufactured home, in a flood-hazard zone shall be prepared by a qualified registered professional engineer or architect to ensure the compliance with 780 CMR 120.G501.

> **Exception**: If a substantial improvement consists exclusively of a lateral addition that does not rely on the support of the existing structure, only the lateral addition must be erected in accordance with the applicable provisions of 780 CMR 120.G501. In that event, the existing structure is not required to come into compliance with 780 CMR 120.G501.
>
> **Note**: If located in a coastal dune that is significant to flood control and/or storm damage prevention, a building or structure, including a new or replacement manufactured home, in a flood-hazard zone shall be designed and constructed in accordance with the applicable provisions of 780 CMR 120.G701, and 120.G801 as well as 780 CMR 120.G501.

120.G501.2 Elevation in a Flood-hazard Zone. Except as otherwise provided in 120.G501, all buildings or structures, including new or replacement manufactured homes, erected or substantially improved within a flood-hazard zone shall be elevated so that the lowest floor is located at or above the base flood elevation. All basement/

cellar floor surfaces shall be located at or above the base flood elevations.

> **Exception**: Floors of occupancy in any use group, other than use group R, below the base flood elevation shall conform to 780 CMR 120.G501.5.2. Floors of occupancies in any use group which are utilized solely for structure means of egress, incidental storage garages and parking, and which are located below the base flood elevation, shall conform to 780 CMR 120.G501.4.

120.G501.3 Anchorage in a Flood-hazard Zone. The structural systems of all buildings or structures, including new or replacement manufactured homes, shall be designed, connected and anchored to resist flotation, collapse or permanent lateral movement due to structural loads and stresses from flooding equal to the base flood elevation and shall be designed in accordance with 780 CMR 1615.2 and 1615.3.

120.G501.4 Enclosures below Base Flood Elevation in a Flood-hazard Zone. Enclosed spaces below the base flood elevation shall not be used for human occupancy with the exception of structural means of egress, entrance foyers, stairways and incidental storage. Fully enclosed spaces shall be designed to equalize automatically hydrostatic forces on exterior walls by allowing for the entry and exit of floodwaters. Designs for meeting this requirement shall either be certified by a registered design professional in accordance with 780 CMR 120.G501.11 through 120.G501.13 or conform to the following minimum criterion: a minimum of two openings having a total net area of not less than one square inch (645 mm^2) for every one square foot (0.1 m^2) of enclosed area subject to flooding shall be provided. The bottom of all openings shall not be higher than 12 inches (305 mm) above grade immediately adjacent to the location of the opening. Openings shall not be equipped with screens, louvers, valves or other coverings or devices unless such devices permit the automatic entry and discharge of floodwaters.

120.G501.5 Water-resistant Construction in a Flood-hazard Zone. Occupancies in any use group other than Use Group R may, in lieu of meeting the elevation provisions of 780 CMR 120.G501.2 be erected with floors usable for human occupancy below the base flood elevation provided that the following conditions are met:

1. All space below the base flood elevation shall be constructed with walls and floors that are substantially impermeable to the passage of water.
2. All structural components subject to hydrostatic and hydrodynamic loads and stresses during the occurrence of flooding to the base flood elevation shall be capable of resisting such forces, including the effects of buoyancy.
3. All openings below the base flood elevation shall be provided with water-tight closures and shall have adequate structural capacity to support all flood loads acting upon the closure surfaces.
4. All floor and wall penetrations for plumbing, mechanical and electrical systems shall be made water tight to prevent floodwater seepage through spaces between the penetration and wall construction materials. Sanitary sewer and storm drainage systems that have openings below the base flood elevation shall be provided with shutoff valves or closure devices to prevent backwater flow during conditions of flooding.

120.G501.6 Repair or Replacement of Existing Foundations in a Flood-hazard Zone. Existing foundations in a flood-hazard zone may be repaired without further compliance with 780 CMR 120.G501, unless the work replaces the foundation in total, replaces the foundation so as to constitute new construction or constitutes a substantial repair of a foundation as defined in 780 CMR 120.G201. In such events, the foundation shall be brought into compliance with the applicable provisions of 780 CMR 120.G501.

See Note 780 CMR 120.G501.1.

120.G501.7 Protection of Mechanical and Electrical Systems in a Flood-hazard Zone. New and replacement electrical, heating, ventilating, air conditioning and other service equipment in a flood-hazard zone shall either be placed above the base flood elevation or protected so as to prevent water from entering or accumulating within the system components during floods up to the base flood elevation in accordance with the mechanical code listed in 780 CMR 100.0 Installation of electrical wiring and outlets, switches, junction boxes and panels below the base flood elevation shall conform to the provisions of 527 CMR 12.00 listed in 780 CMR 100.0 for location of such items in wet locations. Duct insulation subject to water damage shall not be installed below the base flood elevation.

120.G501.8 Construction Materials, Methods, and Practices in a Flood-hazard Zone. All buildings or structures, including new or replacement manufactured homes, erected in a flood-hazard zone shall be constructed with materials resistant to flood damage and be constructed by methods and practices that minimize flood damage. Construction materials shall be resistant to water damage in accordance with the provisions of 780 CMR 1808.0, 1810.2, 1813.4, 2307.2, 2309.1, 2311.4, 2311.6, and 2503.4.

120.G501.9 Recreational Vehicles in a Flood-hazard Zone. All recreational vehicles placed in a flood-hazard zone and that are not fully licensed and ready for highway use or that are to be placed on a site for more than 180 consecutive days shall comply with the provisions of 780 CMR 120.G501 applicable to buildings or structures, including new or replacement manufactured homes.

120.G501.10 Alterations, Renovation and Repairs in a Flood-hazard Zone. Alterations, renovations and repairs to existing buildings and structures including new or replacement manufactured homes located in a flood-hazard zone shall comply with applicable provisions of 780 CMR. Compliance with 780 CMR 120.G501 is required whenever such alteration, renovation or repair constitutes a substantial repair of a foundation as defined in 780 CMR 120.G201, repair or replacement of a foundation that requires compliance with 780 CMR 120.G501, or a substantial improvement as defined in 780 CMR 120.G201.

120.G501.11 Certifications and Plans for Construction in a Flood-hazard Zone. Certifications and plans shall be submitted in accordance with 780 CMR 120.G501.12 and 120.G501.13 for a substantial repair of a foundation as defined in 780 CMR 120.G201, repair or replacement of a foundation that requires compliance with 780 CMR 120.G501, a substantial improvement as defined in 780 CMR 120.G201, or a building or structure as defined in 780 CMR 120.G201, including a new or replacement manufactured home.

120.G501.12 As-built Elevation Certification for Construction in a Flood-hazard Zone. For all substantial repairs of a foundation as defined in 780 CMR 120.G201, all repairs or replacement of a foundation that trigger the requirement to comply with 780 CMR 120.G501, all substantial improvements as defined in 780 CMR 120.G201, and all buildings or structures including new and replacement manufactured homes, a licensed land surveyor or registered design professional shall certify the actual elevation in relation to the base flood elevation of the lowest floor required to be elevated by the provisions of 780 CMR 120.G501.2. The certification required shall be submitted to the building official after the construction of the foundation is complete and before the commencement of any other work on the building or structure or, if there is no other work, the occupancy of the building or structure.

120.G501.13 Documentation -Water Resistant Construction in a Flood-hazard Zone. Where buildings or structures including new or replacement manufactured homes are to be constructed in accordance with 780 CMR 120.G501.5, the building official shall require that a registered design professional provide construction documents showing proposed details of floor, wall, foundation support components, loading computations, and other essential technical data used in meeting the conditions of 780 CMR 120.G501.5. The construction documents shall be accompanied by a statement bearing the signature of the registered design professional indicating that the design and proposed methods of construction are in accordance with applicable provisions of 780 CMR 120.G501.5.

780 CMR 120.G601 HIGH HAZARD ZONES

120.G601.1. Construction in High-hazard Zones (V Zones). Areas of tidal influence which have been determined to be subject to wave heights in excess of three feet (914 mm) or subject to high-velocity wave run-up or wave-induced erosion shall be classified as high- hazard zones. High-hazard zones shall include all areas shown as V Zones on the most recent Flood Hazard Boundary Map or FIRM. All buildings or structures as defined in 780 CMR 120.G201, including new or replacement manufactured homes, erected or substantially improved in a high-hazard zone shall be designed and constructed in accordance with 780 CMR 120.G601. All lateral additions of a building or structure in a high-hazard zone shall also be designed and constructed in accordance with 780 CMR 120.G601 whether or not the lateral addition constitutes a substantial improvement. Plans for a building, structure, substantial improvement, or lateral addition in a high-hazard zone shall be prepared by a registered professional engineer or architect to ensure compliance with 780 CMR 120.G601.

> **Note**: If located in a coastal dune significant to flood control and/or storm damage prevention and a high-hazard zone, a building, structure, including a new or replacement manufactured home, a lateral addition, and a substantial improvement of a building or structure that has suffered substantial damage as a result of flooding or storms shall be designed and constructed in accordance with 780 CMR 120.G701 and 120.G801 as well as 120.G601.
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> **120.G601.1.1 High-hazard Zone Construction Documents Requirements**. Where buildings or structures are to be constructed in accordance with 780 CMR 120.G601, the building official shall require that a registered design professional provide construction documents showing proposed details of foundation support and connection components which are used in meeting the requirements of 780 CMR 120.G601.4. Where solid walls or partitions are proposed that are less than two feet above the base flood elevations, wall, framing and connection details of such walls shall be provided, including loading computations for the wall and foundation system used in meeting the conditions of 780 CMR 120.G601.3. The construction documents shall be accompanied by a statement bearing the signature of the registered design professional indicating that the design and proposed methods of construction are in accordance with all applicable provisions of 780 CMR 120.G601.

120.G601.2 Elevation in a High-hazard Zone. All buildings or structures including new and replacement manufactured homes erected or substantially improved within a high-hazard zone shall be elevated so that the bottom of the lowest horizontal structural member supporting the lowest floor, with the exception of mat or raft foundations, piling, pile caps, columns, grade beams and bracing, is located at an elevation that is at least two feet above the base flood elevation. All lateral additions erected in a high- hazard zone shall also be elevated so that the lowest portion of all structural members supporting the lowest floor of the lateral addition with the exception of mat or raft foundations, pilings, pile caps, columns, grade beams and bracing shall also be located at an elevation that is at least two feet above the base flood elevation.

120.G601.3 Enclosures below Base Flood Elevation in a High-hazard Zone. All spaces that are less than two feet above the base flood elevation in a high-hazard zone shall not be used for human occupancy and shall be free of obstruction except as permitted in 780 CMR 120.G601.3:

1. Mat or raft foundations, piling, pile caps, bracing, grade beams and columns which provide structural support for the building.
2. Entrances and exits which are necessary for required ingress and means of egress.
3. Incidental storage of portable or mobile items readily moved in the event of a storm.
4. Walls and partitions are permitted to enclose all or part of the space below the elevated floor provided that such walls and partitions are not part of the structural support of the building and are constructed with insect screening, open wood lattice, or nonsupporting walls designed to break away or collapse without causing collapse, displacement or other structural damage to the elevated portion of the building or supporting foundation system due to the effect of wind loads as specified in 780 CMR 1611.0 and water loads as specified in 780 CMR 1615.0 acting simultaneously. Any such nonsupporting solid wall shall be certified as specified in 780 CMR 120.G601.10 and 120.G601.11.

120.G601.4 Foundations in a High-hazard Zone. All buildings or structures, including new and replacement manufactured homes, erected or substantially improved in high-hazard zones shall be supported on pilings or columns and shall be adequately anchored to such pilings or columns. All lateral additions in high-hazard zones shall also be supported on pilings or columns and shall be adequately anchored to such pilings or columns. The piling shall have adequate soil penetrations to resist the combined wave and wind loads (lateral and uplift) to which such piles are likely to be subjected during a flood to the base flood elevation. Pile embedment shall include consideration of decreased resistance capacity caused by scour of soil strata surrounding the piling. Pile system design and installation shall also be made in accordance with the provisions of 780 CMR 1816.0 and 1817.0. Mat or raft foundations which support columns shall not be permitted where soil investigations required in accordance with 780 CMR 1802.1 indicate that soil material under the mat or raft is subject to scour or erosion from wave-velocity flow conditions.

120.G601.5 Repair or Replacement of Existing Foundations in a High-hazard Zone. Existing foundations may be repaired in a high-hazard zone without further compliance with 780 CMR 120.G. unless the work replaces the foundation in total, replaces the foundation so as to constitute new construction, or constitutes a substantial repair of a foundation as defined in 780 CMR 120.G201. In such events, the foundation shall be brought into compliance with the applicable provisions of 780 CMR 120.G601.

See Note to 780 CMR 120.G601.1.

120.G601.6. Protection of Mechanical and Electrical Systems in a High-hazard Zone. New and replacement electrical equipment and heating, ventilating, air conditioning and other service equipment in a high- hazard zone shall be either placed at least two feet above the base flood elevation or protected so as to prevent water from entering or accumulating within the system components during floods in accordance with the mechanical code listed in 780 CMR 100.0. Installation of electrical wiring and outlets, switches, junction boxes and panels that are less than two feet above the base flood elevation shall conform to the provisions of 527 CMR 12.00 listed in 780 CMR 100.0 for location of such items in wet locations. Duct insulation subject to water damage shall be installed at least two feet above the base flood elevation.

120.G601.7. Construction Materials, Methods and Practices in a High-hazard Zone. All buildings or structures including new or replacement manufactured homes erected in high-hazard zones (V Zones) shall be constructed with materials resistant to flood damage and be constructed by methods and practices that minimize flood damage Construction materials shall be resistant to water damage in accordance with the provisions of 780 CMR 1808.0, 1810.2, 1813.4, 2307.2, 2309.1, 2311.4, 2311.6 and 2503.4.

120.G601.8 Recreational Vehicles in a High-hazard Zone: Recreational vehicles placed in a high-hazard zone and that are not fully licensed and ready for highway use or that are to be placed on a site for more than 180 consecutive days shall comply with the provisions of 780 CMR 120.G601 applicable to buildings or structures including new or replacement manufactured homes.

120.G601.9 Alterations, Renovations and Repairs in a High-hazard Zone. Alterations, renovations and repairs to existing buildings, including manufactured homes, located in a high-hazard zone shall comply with all applicable provisions of 780 CMR. Compliance with 780 CMR 120.G. is required whenever such alteration, renovation or repair constitutes substantial repair of a foundation as defined in 780 CMR 120.G201, the repair or replacement of a foundation that requires compliance with 780 CMR 120.G601. as set forth in 780 CMR 120.G601.5, a substantial improvement as defined in 780 CMR 120.G201, or a lateral addition as defined in 780 CMR 120.G201.

120.G601.10 Certifications and Plans for Construction in a High-hazard Zone. Certifications and plans shall be submitted in accordance with 780 CMR 120.G601.10 and 120.G601.11 for a substantial repair of a foundation as defined in 780 CMR 120.G201, a repair or replacement of a foundation that requires compliance with 780 CMR 120.G601, a substantial improvement as defined in 780 CMR 120.G201, a lateral addition as defined in 780 CMR 120.G201, or a building, or structure, including a new and replacement manufactured home.

120.G601.11 As-built Elevation Certifications for Construction in a High-hazard Zone. For all substantial repairs of a foundation as defined 780 CMR 120.G201, all repairs or replacements of a foundation that trigger the requirement to comply with 780 CMR 120.G601, all substantial improvements as defined in 780 CMR 120.G201, all lateral additions as defined in 780 CMR 120.G201, and all buildings and structures, including new and replacement manufactured homes, a licensed land surveyor or registered design professional shall certify the actual elevation (in relation to the base flood elevation) of the lowest horizontal structural member required to be elevated by the provisions of 780 CMR 120.G601.2. The certification required herein shall be submitted to the building official after the construction of the foundation is complete and before the commencement of any other work on the building or structure or, if there is no other work, the occupancy of the building or structure.

120.G701 COASTAL DUNES

120.G701.1 Determination of Coastal Dunes. To reduce flood damage, ensure the structural integrity of buildings or structures including manufactured homes, located in coastal dunes, to protect the public safety and to eliminate certain conflicts between the coastal dune performance standards set forth in the Wetlands Protection Act Regulations, 310 CMR 10.28, and this Code, 780 CMR 120.G701 and 120.G801 establish requirements for design and construction in coastal dunes significant to the interests of flood control and/or storm damage prevention identified in 310 CMR 10.28: *Coastal Dunes*.

To determine whether a proposed building or structure, including a manufactured home, a lateral addition, work on a foundation that under 780 CMR 120.G801.6 requires compliance with 780 CMR 120.G801,or substantial improvement to a building or structure that has incurred substantial damage as a result of flooding and/or storms is located within an area that is a coastal dune significant to the interests of flood control and/or storm damage prevention, the building official shall require the submission of certain construction documents in accordance with 780 CMR 120.G701.1.

120.G701.1.1 Submission of Construction Documents for Proposed Work in a Coastal Wetland Resource Area. For all buildings or structures, including new or replacement manufactured homes, all lateral additions, all work on a foundation that under 780 CMR 120.G801.6 requires compliance with 120.G801, and all substantial improvements of a building or structure that has incurred substantial damage as a result of flooding and/or storms proposed on a parcel of land that is located wholly or partially within a coastal wetland resource area shown on the map entitled "Map of Coastal Wetland Resources For Building Officials", the building official shall require submission of one of the construction documents specified in 780 CMR 120.G701.1.1(a) through (d) along with a notarized statement by the applicant that the Order, Determination or Notice is in effect and is not the subject of any administrative appeals before the Department of Environmental Protection or the Division of Administrative Law Appeals. No building permit shall issue unless and until a construction document that conforms to the requirements of 780 CMR 120.G701.1 including 120.G701.1(a) through (d) below is submitted.

(a) An Order of Conditions establishing the boundaries of all coastal wetland resource areas in a plan referenced in and accompanying the Order. The Order together with the plan referenced therein shall identify the boundaries of all coastal wetland resource areas including coastal dunes and determine whether the coastal wetland resource areas are significant to any of the interests identified in M.G.L. c. 131, § 40 (the Wetlands Protection Act) including the interests of flood control and storm damage prevention. If the Order of Condition and the plan referenced therein indicate that the proposed construction work is located within a coastal dune that is significant to the interests of flood control and/or storm damage prevention, the Order of Conditions must allow the proposed construction.

(b) An Order of Resource Area Delineation stating that the proposed construction work is outside the boundaries of all coastal wetland resource areas as shown on a plan referenced in and accompanying the Order.

(c) A Determination of Applicability stating that the proposed construction work is outside the boundaries of all coastal wetland resource areas as shown on a plan referenced in and accompanying the Determination or will not fill, dredge or alter a coastal wetland resource area.

(d) A Notice of Non-significance evidencing that the proposed construction work is within a coastal wetland resource area as shown on a plan referenced in and accompanying the Notice and stating that the coastal wetland resource area is not significant to any of the interests identified in M.G.L. c. 131, § 40 (the Wetlands Protection Act).

120.G801 CONSTRUCTION IN COASTAL DUNES

120.G801.1 Requirements for Design and Construction in Coastal Dunes. All buildings and structures including manufactured homes, all lateral additions, all substantial improvements to a building or structure that has incurred substantial damage as a result of flooding and/or storms, and all work on a foundation that under 780 CMR 120.G801.6 requires compliance with 780 CMR 120.G801, that are proposed within an area that is a coastal dune significant to the interests of storm damage prevention and/or flood control shall comply with the provisions of 780 CMR 120.G801 including 120.G801.1 through 120.G801.11. The determination of whether such construction work is proposed to be located within an area that is a coastal dune significant to the interests of storm damage prevention and/or flood control shall be based solely on the construction documents submitted to the building official in accordance with 780 CMR 120.G701 including 120.G701.1.1(a) through (d). If the proposed construction work is also located in a flood-hazard zone or a high-hazard zone, the construction work shall also comply with applicable provisions of 780 CMR 120.G501 or 120.G601, as applicable.

Note 1: A lateral addition proposed to be constructed within a coastal dune that is significant to the interests of flood control and/or storm damage prevention shall be constructed in accordance with 780 CMR 120.G801.1 through 120.G801.11 whether or not the lateral addition is a substantial improvement as defined in 780 CMR 120.G201.

Note 2: A substantial improvement to a building or structure including a manufactured home, that is located in a coastal dune that is significant to the interests of flood control and/or storm damage prevention and that has not incurred substantial damage as a result of flooding or storms does not trigger the requirement that the existing building or structure be brought into compliance with 780 CMR 120.G801.1 through 120.G801.11.

Note 3: If located in a flood hazard-zone or a high hazard zone, a substantial improvement to a building or structure, including a manufactured home, in a coastal dune that is significant to flood control and/or storm damage prevention must comply with all applicable provisions of 780 CMR 120.G501 or 120.G601.

120.G801.2 Plans for Construction in a Coastal Dune. All plans for the construction of a building or structure including a new or replacement manufactured home and all plans for a lateral addition as defined in 780 CMR 120.G201, a substantial improvement of a building or structure that has incurred substantial damage as a result of flooding and/or storms, work on a foundation that under 780 CMR 120.G801.6 requires compliance with 780 CMR 120.G as applicable, proposed within an area that is a coastal dune significant to the interests of flood control and/or storm damage prevention shall be prepared by a registered professional engineer or architect to ensure compliance with 120.G801.3 through 120.G.8.11.

120.G801.3 Foundation Types in a Coastal Dune. All buildings, structures, or lateral additions, and substantial improvements to a building or structure that has incurred substantial damage as a result of storms and/or flooding that are located in a coastal dune significant to the interests of flood control and/or storm damage prevention shall be supported on open pilings without footings to allow the lateral movement of the dune and shall be adequately anchored to such pilings. The pilings shall have adequate soil penetration to resist the combined wave and wind loads (lateral and uplift) to which such piles are likely to be subjected during storm events. Pile embedment shall include consideration of decreased resistance capacity caused by scour of soil strata surrounding the piling. Pile system design and construction shall be made in accordance with the provisions of 780 CMR 1816.0 and 1817.0.

Exception: Where surface or subsurface conditions consist of nonerodible soil that prevents the use of pile foundations, spread footing or mat foundations may be permitted provided they are anchored to prevent sliding, uplift or overturning to nonerodible soil with sufficient strength to withstand forces from the combinations of load.

Note: An Order of Conditions is required for the construction of a new foundation in a coastal dune that is significant to the interests of flood control or storm damage prevention. An Order of Conditions is also required for work on a foundation that under 780 CMR 120.G8.6 requires compliance with 780 CMR 120.G801. To allow the lateral movement of the dune, the Order of Conditions may impose additional requirements or restrictions on the use of certain foundation types based on site-specific factors. All foundations in such a coastal dune must also be designed and constructed in accordance with the Order of Conditions.

120.G801.4 Elevation in a Coastal Dune. Within a coastal dune that is significant to the interests of flood control and/or storm damage prevention, all buildings or structures including new and replacement manufactured homes, all lateral additions as defined in 780 CMR 120.G201, and all substantial improvements of a building or structure that has incurred substantial damage as a result of flooding or storms shall be erected so that the bottom of the lowest horizontal structural member of the lowest floor with the exception of pilings or pile caps is located at the elevation required by the Order of Conditions.

Note: Orders of Conditions issued by a Conservation Commission may be appealed to the Massachusetts Department of Environmental Protection and the Division of Administrative Law Appeals by following the procedures set forth in 310 CMR 10.05(7).

120.G801.5 Recreational Vehicles in a Coastal Dune. Recreational vehicles placed in a coastal dune that is significant to the interests of flood control and/or storm damage prevention and that either are not fully licensed and ready for highway use or placed on the coastal dune for more than 180 consecutive days shall be designed and constructed in accordance with the requirements of 780 CMR 120.G801.1 through 801.11 applicable to buildings or structures including new or replacement manufactured homes.

120.G801.6 Repair or Replacement of Existing Foundations in a Costal Dune. Except as otherwise provided herein, existing foundations in a coastal dune significant to the interests of flood control and/or storm damage prevention may be repaired without further compliance with 780 CMR 120.G, as applicable. Existing foundation systems in a coastal dune significant to the interests of flood control and/or storm damage prevention, which are replaced in total, which are replaced so as to constitute new construction, or any substantial repair of a foundation as defined in 780 CMR 120.G201 shall trigger the requirement that the foundation be brought into compliance with the applicable provisions of 780 CMR 120.G801 including 780 CMR 120.G801.3 and 120.G801.4.

120.G801.7 Substantial Improvement of a Building or Structure, Including a Manufactured Home, That Is Located in a Coastal Dune and Has Suffered Substantial Damage.. All substantial improvements to a building or structure including a manufactured home that is located in a coastal dune that is significant to flood control and/or storm damage prevention, and that has incurred substantial damage as a result of flooding or storms shall be subject to the requirements in 780 CMR 120.G701 and 780 CMR 120.G801 applicable to buildings or structures including without limitation the elevation and foundation type requirements of 780 CMR 120.G801.3 and 120.G801.4.

120.G801.8 Protection of Mechanical and Electrical Equipment in a Coastal Dune. New and replacement electrical equipment, heating, ventilating, air conditioning and other service equipment in a coastal dune that is significant to the interests of flood control and/or storm damage prevention shall be placed at the elevation required by the Order of Conditions.

120.G801.9 Certifications and Plans for Construction in a Coastal Dune. Certifications and plans in accordance with 780 CMR 120.G801.10 and 120.G801.11 shall be submitted for the following construction work in a coastal dune significant to the interests of flood control and/or storm damage prevention: all work on a foundation that under 780 CMR 120.G801.6 requires compliance with 780 CMR 120.G801, all lateral additions as defined in 780 CMR 120.G201, all buildings or structures, including new and replacement manufactured homes, and all substantial improvements of a building or structure that has incurred substantial damage as a result of flooding and/or storms.

120.G801.10 As-built Elevation Certification for Construction in a Coastal Dune. After the construction of the foundation is complete and before the commencement of any other work on the building or structure including a new or replacement manufactured home, or if there is no other work, the occupancy of the structure, a licensed land surveyor or registered design professional shall submit certification to the building official that the actual elevation of the lowest horizontal structural member in relation to the elevation of the dune prior to the start of construction meets or exceeds the requirements of 780 CMR 120.G801.4.

120.G801.11 Coastal Dune Construction Documents. The building official shall require that the registered design professional provide construction documents showing details of foundation support and components, loading computations and other essential data demonstrating compliance with the requirements of 780 CMR 120.G801 including 120.G801.3 and 120.G801.4 for the following construction work in a coastal dune significant to the interests of flood control and/or storm damage prevention: all work on a foundation that under 780 CMR 120.G801.6 requires compliance with 780 CMR 120.G801, all lateral additions as defined in 780 CMR 120.G201, all buildings or structures as defined in 780 CMR 120.G201, including new and replacement manufactured homes, and all substantial improvements of a building or structure that has incurred substantial damage as a result of flooding or storms. The construction documents shall be accompanied by a statement bearing the signature of the registered design professional indicating that the design and proposed methods of construction are in accordance with applicable provisions of 780 CMR 120.G801 including 120.G801.3 through 120.G8

780 CMR 120.H

SIGNS

780 CMR 120.H101 GENERAL

120.H101.1 General. A sign shall not be erected in a manner that would confuse or obstruct the view of or interfere with exit signs required by Chapter 10 or with official traffic signs, signals or devices. Signs and sign support structures, together with their supports, braces, guys and anchors, shall be kept in repair and in proper state of preservation. The display surfaces of signs shall be kept neatly painted or posted at all times.

120.H101.2 Signs Exempt from Building Permits. The following signs are exempt from the requirements to obtain a permit before erection:

1. ***Paint-only*** nonilluminated signs.
2. Temporary signs announcing the sale or rent of property.
3. Signs erected by transportation authorities.
4. Projecting signs not exceeding 2.5 square feet (0.23 m^2).
5. The changing of moveable parts of an approved sign that is designed for such changes, or the repainting or repositioning of display matter shall not be deemed an alteration.

780 CMR 120.H102 DEFINITIONS

120.H102.1 General. Unless otherwise expressly stated, the following words and terms shall, for the purposes of this appendix, have the meanings shown in 780 CMR 120.H102. Refer to 780 CMR 2.00 for general definitions.

COMBINATION SIGN. A sign incorporating any combination of the features of pole, projecting and roof signs.

DISPLAY SIGN. The area made available by the sign structure for the purpose of displaying the advertising message.

ELECTRIC SIGN. A sign containing electrical wiring, but not including signs illuminated by an exterior light source.

GROUND SIGN. A billboard or similar type of sign which is supported by one or more uprights, poles or braces in or upon the ground other than a combination sign or pole sign, as defined by 780 CMR.

POLE SIGN. A sign wholly supported by a sign structure in the ground.

PORTABLE DISPLAY SURFACE. A display surface temporarily fixed to a standardized advertising structure which is regularly moved from structure to structure at periodic intervals.

PROJECTING SIGN. A sign other than a wall sign, which projects from and is supported by a wall of a building or structure.

ROOF SIGN. A sign erected upon or above a roof or parapet of a building or structure.

SIGN. Any letter, figure, character, mark, plane, point, marquee sign, design, poster, pictorial, picture, stroke, stripe, line, trademark, reading matter or illuminated service, which shall be constructed, placed, attached, painted, erected, fastened or manufactured in any manner whatsoever, so that the same shall be used for the attraction of the public to any place, subject, person, firm, corporation, public performance, article, machine or merchandise, whatsoever, which is displayed in any manner outdoors. Every sign shall be classified and conform to the requirements of that classification as set forth in 780 CMR 120.H.

SIGN STRUCTURE. Any structure which supports or is capable of supporting a sign as defined in 780 CMR. A sign structure is permitted to be a single pole and is not required to be an integral part of the building.

WALL SIGN. Any sign attached to or erected against the wall of a building or structure, with the exposed face of the sign in a plane parallel to the plane of said wall.

780 CMR 120.H103 LOCATION

120.H103.1 Location Restrictions. Signs shall not be erected, constructed or maintained so as to obstruct any fire escape or any window or door or opening used as a means of egress or so as to prevent free passage from one part of a roof to any other part thereof. A sign shall not be attached in any form, shape or manner to a fire escape, nor be placed in such manner as to interfere with any opening required for ventilation.

A sign shall not be located in violation of local zoning requirements.

780 CMR 120.H104 IDENTIFICATION

120.H104.1 Identification. Every outdoor advertising display sign hereafter erected, constructed or maintained, for which a permit is required shall be plainly marked with the name of the person, firm or corporation erecting and maintaining such sign and shall have affixed on the front thereof the permit number issued for said sign or other method of identification approved by the building official.

780 CMR 120.H105 DESIGN AND CONSTRUCTION

120.H105.1 General Requirements. Signs shall be designed and constructed to comply with the provisions of 780 CMR for use of materials, loads and stresses.

120.H105.2 Permits, Drawings and Specifications. Where a permit is required, as provided in 780 CMR 1.00, construction documents shall be required. These documents shall show the dimensions, material and required details of construction, including loads, stresses and anchors.

120.H105.3 Wind Load. Signs shall be designed and constructed to withstand wind pressure as provided for in 780 CMR 16.00.

120.H105.4 Seismic Load. Signs designed to withstand wind pressures shall be considered capable of withstanding earthquake loads, except as provided for in 780 CMR 16.00.

120.H105.5 Working Stresses. In outdoor advertising display signs, the allowable working stresses shall conform to the requirements of 780 CMR 16.00. The working stresses of wire rope and its fastenings shall not exceed 25% of the ultimate strength of the rope or fasteners.

Exceptions:

1. The allowable working stresses for steel and wood shall be in accordance with the provisions of 780 CMR 22.00 and 23.00.
2. The working strength of chains, cables, guys or steel rods shall not exceed one-fifth of the ultimate strength of such chains, cables, guys or steel.

120.H105.6 Attachment. Signs attached to masonry, concrete or steel shall be safely and securely fastened by means of metal anchors, bolts or approved expansion screws of sufficient size and anchorage to safely support the loads applied.

780 CMR 120.H106 ELECTRICAL

120.H106.1 **Illumination**. A sign shall not be illuminated by other than electrical means, and electrical devices and wiring shall be installed in accordance with the requirements of 527 CMR 12.00: *Massachusetts Electrical Code*.

120.H106.1.1 Internally Illuminated Signs. Except as provided for in 780 CMR 402.14 and 2611, where internally illuminated signs have sign facings of wood or approved plastic, the area of such facing section shall not be more than 120 square feet (11.16 m^2) and the wiring for electric lighting shall be entirely enclosed in the sign cabinet with a clearance of not less than two inches (51 mm) from the facing material. The dimensional limitation of 120 square feet (11.16 m^2) shall not apply to sign facing sections made from flame- resistant-coated fabric (ordinarily known as "flexible sign face plastic") that weighs less than 20 ounces per square yard (678 g/m^2) and which, when tested in accordance with NFPA 701, meets the requirements of both the small-scale test and the large-scale test, or which, when tested in accordance with an approved test method, exhibits an average burn time for ten specimens of two seconds or less and a burning extent of 15 centimeters or less.

120.H106.2 **Electrical Service**. Signs that require electrical service shall comply with 527 CMR 12.00: *Massachusetts Electrical Code*.

780 CMR 120.H107 COMBUSTIBLE MATERIALS

120.H107.1 Use of Combustibles. Wood, approved plastic or plastic veneer panels as provided for in 780 CMR 26.00, or other materials of combustible characteristics similar to wood, used for moldings, cappings, nailing blocks, letters and latticing, shall comply with 780 CMR 120.H109.1, and shall not be used for other ornamental features of signs, unless approved.

120.H107.1.1 Plastic Materials. Notwithstanding any other provisions of 780 CMR plastic materials which burn at a rate no faster than 2.5 inches per minute (64 mm/s) when tested in accordance with ASTM D 635 shall be deemed approved plastics and can be used as the display surface material and for the letters, decorations and facings on *outdoor* signs and outdoor display structures.

Note: For signs, other than those identified in 780 CMR 120.H101.2 and that are used indoors, plastic sign materials shall conform to the applicable requirements set forth in 780 CMR 26.00.

120.H107.1.2 Electric Sign Faces. Individual plastic facings of electric signs shall not exceed 200 square feet (18.6 m^2) in area.

120.H107.1.3 Area Limitation. If the area of a display surface exceeds 200 square feet (18.6 m^2), the area occupied or covered by approved plastics shall be limited to 200 square feet (18.6 m^2) plus 50% of the difference between 200 square feet (18.6 m^2) and the area of display surface. The area of plastic on a display surface shall not in any case exceed 1,100 square feet (102 m^2).

120.H107.1.4 Plastic Appurtenances. Letters and decorations mounted on an approved plastic facing or display surface can be made of approved plastics.

780 CMR 120.H108 ANIMATED DEVICES

120.H108.1 Fail-safe Device. Signs that contain moving sections or ornaments shall have fail-safe provisions to prevent the section or ornament from releasing and falling or shifting its center of gravity more than 15 inches (381 mm). The fail-safe device shall be in addition to the mechanism and the mechanism's housing which operate the movable section or ornament. The fail-safe device shall be capable of supporting the full dead weight of the section or ornament when the moving mechanism releases.

780 CMR 120.H109 GROUND SIGNS

120.H109.1 Height Restrictions. The structural frame of ground signs shall not be erected of combustible materials to a height of more than 35 feet (10668 mm) above the ground. Ground signs constructed entirely of noncombustible material shall not be erected to a height of greater than 100 feet (30 480 mm) above the ground. Greater heights are permitted where approved and located so as not to create a hazard or danger to the public.

120.H109.2 Required Clearance. The bottom coping of every ground sign shall be not less than three feet (914 mm) above the ground or street level, which space can be filled with platform decorative trim or light wooden construction.

120.H109.3 Wood Anchors and Supports. Where wood anchors or supports are embedded in the soil, the wood shall be pressure treated with an approved preservative.

780 CMR 120.H110 ROOF SIGNS

120.H110.1 General. Roof signs shall be constructed entirely of metal or other approved noncombustible material except as provided for in 780 CMR 120.H106.1.1 and 120.H107.1. Provisions shall be made for electric grounding of metallic parts. Where combustible materials are permitted in letters or other ornamental features, wiring and tubing shall be kept free and insulated there from. Roof signs shall be so constructed as to leave a clear space of not less than six feet (1829 mm) between the roof level and the lowest part of the sign and shall have at least five feet (1524 mm) clearance between the vertical supports thereof. No portion of any roof sign structure shall project beyond an exterior wall.

Exception: Signs on flat roofs with every part of the roof accessible.

120.H110.2 Bearing Plates. The bearing plates of roof signs shall distribute the load directly to or upon masonry walls, steel roof girders, columns or beams. The building shall be designed to avoid overstress of these members.

120.H110.3 Height of Solid Signs. A roof sign having a solid surface shall not exceed, at any point, a height of 24 feet (7315 mm) measured from the roof surface.

120.H110.4 Height of Open Signs. Open roof signs in which the uniform open area is not less than 40% of total gross area shall not exceed a height of 75 feet (22 860 mm) on buildings of Type 1 or Type 2 construction. On buildings of other construction types, the height shall not exceed 40 feet (12 192 mm). Such signs shall be thoroughly secured to the building upon which they are installed, erected or constructed by iron, metal anchors, bolts, supports, chains, stranded cables, steel rods or braces and they shall be maintained in good condition.

120.H110.5 Height of Closed Signs. A closed roof sign shall not be erected to a height greater than 50 feet (15 240 mm) above the roof of buildings of Type 1 or Type 2 construction, nor more than 35 feet (10 668 mm) above the roof of buildings of Type 3, 4 or 5 construction.

780 CMR 120.H111 WALL SIGNS

120.H111.1 Materials. Wall signs which have an area exceeding 40 square feet (3.72 m^2) shall be constructed of metal or other approved noncombustible material, except for nailing rails and as provided for in 780 CMR H106.1.1 and H107.1.

120.H111.2 Exterior Wall Mounting Details. Wall signs attached to exterior walls of solid masonry, concrete or stone shall be safely and securely attached by means of metal anchors, bolts or expansion screws of not less than ⅜ inch (9.5 mm) diameter and shall be embedded at least five inches (127 mm). Wood blocks shall not be used for anchorage, except in the case of wall signs attached to buildings with walls of wood. A wall sign shall not be supported by anchorages secured to an unbraced parapet wall.

120.H111.3 Extension. Wall signs shall not extend above the top of the wall, nor beyond the ends of the wall to which the signs are attached unless such signs conform to the requirements for roof signs, projecting signs or ground signs.

780 CMR 120.H112 PROJECTING SIGNS

120.H112.1 General. Projecting signs shall be constructed entirely of metal or other noncombustible material and securely attached to a building or structure by metal supports such as bolts, anchors, supports, chains, guys or steel rods. Staples or nails shall not be used to secure any projecting sign to any building or structure. The dead load of projecting signs not parallel to the building or structure and the load due to wind pressure shall be supported with chains, guys or steel rods having net cross-sectional dimension of not less than ⅜ inch (9.5 mm) diameter. Such supports shall be erected or maintained at an angle of at least 45% (0.78 rad) with the horizontal to resist the dead load and at angle of 45% (0.78 rad) or more with the face of the sign to resist the specified wind pressure. If such projecting sign exceeds 30 square feet (2.8 m^2) in one facial area, there shall be provided at least two such supports on each side not more than eight feet (2438 mm) apart to resist the wind pressure.

120.H112.2 Attachment of Supports. Supports shall be secured to a bolt or expansion screw that will develop the strength of the supporting chains, guys or steel rods, with a minimum ⅝-inch (15.9 mm) bolt or lag screw, by an expansion shield. Turn buckles shall be placed in chains, guys or steel rods supporting projecting signs.

120.H112.3 Wall Mounting Details. Chains, cables, guys or steel rods used to support the live or dead load of projecting signs are permitted to be fastened to solid masonry walls with expansion bolts or by machine screws in iron supports, but such supports shall not be attached to an unbraced parapet wall. Where the supports must be fastened to walls made of wood, the supporting anchor bolts must go through the wall and be plated or fastened on the inside in a secure manner.

120.H112.4 Height Limitation. A projecting sign shall not be erected on the wall of any building so as to project above the roof or cornice wall or above the roof level where there is no cornice wall; except that a sign erected at a right angle to the building, the horizontal width of which sign is perpendicular to such a wall and does not exceed 18 inches (457 mm), is permitted to be erected to a height not exceeding two feet (610 mm) above the roof or cornice wall or above the roof level where there is no cornice wall. A sign attached to a corner of a building and parallel to the vertical line of such corner shall be deemed to be erected at a right angle to the building wall.

120.H112.5 Additional Loads. Projecting sign structures which will be used to support an individual on a ladder or other servicing device, whether or not specifically designed for the servicing device, shall be capable of supporting the anticipated additional load, but not less than a 100-pound (445 N) concentrated horizontal load and a 300-pound (1334 N) concentrated vertical load applied at the point of assumed or most eccentric loading. The building component to which the projecting sign is attached shall also be designed to support the additional loads.

780 CMR 120.H113 MARQUEE SIGNS

120.H113.1 Materials. Marquee signs shall be constructed entirely of metal or other approved noncombustible material except as provided for in 780 CMR 120.H106.1.1 and 120.H107.1.

120.H113.2 Attachment. Marquee signs shall be attached to approved marquees that are constructed in accordance with 780 CMR 3106.

120.H113.3 Dimensions. Marquee signs, whether on the front or side, shall not project beyond the perimeter of the marquee.

120.H113.4 Height Limitation. Marquee signs shall not extend more than six feet (1829 mm) above, nor one foot (305 mm) below such marquee, but under no circumstances shall the sign or signs have a vertical dimension greater than eight feet (2438 mm).

782 CMR 120.H114 PORTABLE SIGNS

120.H114.1 General. Portable signs shall conform to requirements for ground, roof, projecting, flat and temporary signs where such signs are used in a similar capacity. The requirements of this section shall not be construed to require portable signs to have connections to surfaces, tie-downs or foundations where provisions are made by temporary means or configuration of the structure to provide stability for the expected duration of the installation.

Table 120.H 4-A
SIZE, THICKNESS AND TYPES OF GLASS PANELS IN SIGNS

MAXIMUM SIZE OF EXPOSED PANEL		MINIMUM THICKNESS OF GLASS (inches)	TYPE OF GLASS
Any dimension (inches)	Area (square inches)		
30	500	⅛	Plain, plate or wired
45	700	3/16	Plain, plate or wired
144	3,600	¼	Plain, plate or wired
>144	>3,600	¼	Wired glass

For SI: 1 inch = 25.4 mm 1 square inch = 645mm^2

TABLE 120.H 4-B
THICKNESS OF PROJECTION SIGN

PROJECTION (feet)	MAXIMUM THICKNESS (feet)
5	2
4	2.5
3	3
2	3.5
1	4

For SI: 1 foot = 304.8 mm

780 CMR 120.H115 REFERENCED STANDARDS

ASTM D 635-98	Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Self-Supporting Plastics in a Horizontal Position	120.H107.1.1
527 CMR 12.00	Massachusetts Electrical Code	120.H106.1, 120.H106.2
NFPA 701-99	Methods of Fire Test for Flame Propagation of Textiles and Films	120.H106.1.1

NON-TEXT PAGE

780 CMR 120.I

PATIO COVERS

(Note: *780 CMR 120.I is unique to Massachusetts*)

780 CMR 120.I101 GENERAL

120.I101.1 Scope. Patio covers shall conform to the requirements of 780 CMR 120.I. Patio covers shall be permitted to be detached from or attached to dwelling units and other Use Group structures. Patio covers shall be used only for recreational, outdoor living purposes and not as carports, garages, storage rooms or habitable rooms. Openings shall be permitted to be enclosed with insect screening, approved translucent or transparent plastic not more that 0.125 inch (3.2 mm) in thickness, glass conforming to the provisions of 780 CMR 53.00 for one- and two-family dwellings or 780 CMR 24.00 for all other USE Groups or any combination of the foregoing

780 CMR 120.I102 DEFINITION

120.I102.1 General. The following term shall, for the purposes of 780 CMR 120.I have the meaning shown in 780CMR 120.I102.

PATIO COVERS. One-story structures not exceeding 12 feet (3657 mm) in height. Enclosure walls shall be permitted to be of any configuration, provided the open or glazed area of the longer wall and one additional wall is equal to at least 65% of the area below a minimum of six feet eight inches (2032 mm) of each wall, measured from the floor. Openings shall be permitted to be enclosed with:

1. *insect screening,*
2. *approved translucent or transparent plastic not more than 0.125 inch (3.2 mm) in thickness,*
3. *glass conforming to the provisions of 780 CMR 5308.0, or 780 CMR 24.00 as applicable or*
4. *any combination of the foregoing.*

780 CMR 120.I103 STRUCTURAL PROVISIONS

120.I103.1 General. Patio covers shall be designed and constructed to sustain, within the stress limits of 780 CMR, all dead loads plus a minimum vertical live load of ten pounds per square foot (0.48 kN/m^2) except that snow loads shall be used where such snow loads exceed this minimum. Such patio covers shall be designed to resist the minimum wind and seismic loads set forth in 780 CMR, as applicable.

120.I103.2 Footings. Patio covers shall be erected on permanent supports extending a minimum of four feet (1.2m) below finished grade except when such supports are placed on solid rock or otherwise protected from frost. All patio cover supports shall be designed for the loads required carried

780 CMR 120.I104 LIGHT AND VENTILATION/EMERGENCY EGRESS

120.I104.1 General. Exterior openings required for light and ventilation shall be permitted to open into a patio structure conforming to 780 CMR 120.I, provided that the patio structure shall be unenclosed if such openings are serving as emergency egress or rescue openings from sleeping rooms. Where such exterior openings serve as an exit from the dwelling unit, the patio structure, unless unenclosed, shall be provided with exits conforming to the provisions of 780 CMR 10.00 or 780 CMR 53.00, as applicable.

780 CMR 120.I105 SPECIAL PROVISIONS FOR ALUMINUM SCREEN ENCLOSURES IN HURRICANE-PRONE REGIONS

120.I105.1 General. Screen enclosures in hurricane-prone regions shall be in accordance with the provisions of 780 CMR 120.I105

120.1105.1.1 Habitable Spaces. Screen enclosures shall not be considered habitable spaces.

120.1105.1.2 Minimum Ceiling Height. Screen enclosures shall have a ceiling height of not less than seven feet (2134 mm) for one- and two-family detached dwellings and seven feet six inches (2286 mm) for all other applications.

120.I105.2 Definitions.

20.I105.1 The following term shall, for the purposes of 780 CMR 120.I, have the meaning shown in 780 CMR 120.I105.2

SCREEN ENCLOSURE. A building or part thereof, in whole or in part self-supporting, and having walls of insect screening and a roof of insect screening, plastic, aluminum, or similar lightweight material.

120.I105.3 Screen Enclosures Minimum Specifications.

120.I105.3.1 Thickness. Actual wall thickness of extruded aluminum members shall be not less than 0.040 inches (1.02 mm).

120.I105.3.2 Density. Screen density shall be a maximum of 20 threads per inch by 20 threads per inch mesh.

120.I105.4 Design.

120.I105.4.1 Wind Load. Structural members supporting screen enclosures shall be designed to support minimum wind loads given in 780 CMR Table 120.I105.4(1) and 120.I105.4(2). Where any value is less than ten psf (0.479 kN/m^2) use ten psf (0.479 kN/m^2).

120.I105.4.2 Deflection Limit. For members supporting screen surfaces only, the total load deflection shall not exceed 1/60. Screen surfaces shall be permitted to include a maximum of 25% solid flexible finishes.

120.I105.4.3 Importance Factor. Utilizing ASCE-7, as referenced in 780 CMR 1604.5, the wind factor for screen enclosures shall be 0.77.

120.I105.4.4 Roof Live Load. The minimum roof live load shall be ten psf (0.479 kN/m^2) except that snow loads shall be used where such snow loads exceed this minimum.

780 CMR TABLE 120.I105.4(1)
DESIGN WIND PRESSURES FOR ALUMINUM SCREEN ENCLOSURE FRAMING WITH AN IMPORTANCE FACTOR OF 0.77[a, b, c]

LOAD CASE	WALL	Basic Wind Speed (mph)											
		100		110		120		130		140		150	
		Exposure Category Design Pressure (psf)											
		C	B	C	B	C	B	C	B	C	B	C	B
A[d]	Windward and leeward walls (flow through) and windward wall (non-flow through) L/W = 0-1	12	8	14	10	17	12	19	14	23	16	26	18
A[d]	Windward and leeward walls (flow through) and windward wall (non-flow through) L/W = 2	13	9	16	11	19	14	22	16	26	18	30	21
B[e]	Windward: Non-gable roof	16	12	20	14	24	17	28	20	32	23	37	26
B[e]	Windward: Gable roof	22	16	27	19	32	23	38	27	44	31	50	36
	ROOF												
All[f]	Roof-screen	4	3	5	4	6	4	7	5	8	6	9	7
All[f]	Roof-solid	12	9	15	11	18	13	21	15	24	17	28	20

For SI: One mile per hour = 0.44 m/s, one pound per square foot = 0.0479kPa, one foot = 304.8 mm.

a. Values have been reduced for 0.77 Importance Factor in accordance with 780 CMR 1604.5 and ASCE-7.

b. Minimum design pressure shall be ten psf in accordance with 780 CMR 1609. If a higher design pressure is determined, then that higher design pressure shall be utilized.

c. Loads are applicable to screen enclosures with a mean roof height of 30 feet or less. For screen enclosures of different heights the pressures given shall be adjusted by multiplying the applicable pressure from 780 CMR Table 120.I105.4(1) by the adjustment factor given in 780 CMR Table 120.I105.4(2).

d. For Load Case A flow-through condition, the pressure given shall be applied simultaneously to both the upwind and downwind screen walls acting in the same direction as the wind. The structure shall also be analyzed for wind coming from the opposite direction. For the non-flow through condition, the screen enclosure wall shall be analyzed for the load applied acting toward the interior of the enclosure

e. For Load Case B, the appropriate Table 120.I105.4(1) pressure multiplied by the projected frontal area of the screen enclosure is the total drag force, including drag on screen surfaces parallel to the wind, which must be transmitted to the ground. Use Load Case A for members directly supporting the screen surfaces perpendicular to the wind. Load Case B loads shall be applied only to structural members which carry wind loads from more than one surface

f. The roof structure shall be analyzed for the pressure given occurring both upward and downward.

780 CMR TABLE 120.I105.4(2)
HEIGHT ADJUSTMENT FACTORS

Mean Roof Height (ft)	EXPOSURE	
	B	C
15	1	0.86
20	1	0.92
25	1	0.96
30	1	1.00
35	1.05	1.03
40	1.09	1.06
45	1.12	1.09
50	1.16	1.11
55	1.19	1.14
60	1.22	1.16

For SI: One foot = 304.8 mm.

780 CMR 120.J

GRADING

780 CMR 120.J101 GENERAL

120.J101.1 Scope. The provisions of 780 CMR 120.J apply to grading, excavation and earthwork construction, including fills and embankments only when directly associated with the construction, reconstruction, alteration, repair and/or demolition of buildings and structures (see M.G.L. c.143, §§ 93 through 100). Where conflicts occur between the technical requirements of 780 CMR 120.J and the soils report, the soils report shall govern.

> ***120.J101.1.1 Appendix Limits Further Delineated. 780 CMR 120.J, contains grading provisions that address soil-related hazards such as slope failure, landslides and erosion that can be encountered in large commercial building developments or in large residential subdivisions where grading problems may arise and that are otherwise not addressed by 780 CMR.***

120.J101.2 Flood Hazard Areas. The provisions of 780 CMR 120.J shall not apply to grading, excavation and earthwork construction, including fills and embankments, in floodways within flood hazard areas established in 780 CMR 1612 and 780 CMR 120.G unless it has been demonstrated through hydrologic and hydraulic analyses performed in accordance with standard engineering practice that the proposed work will not result in any increase in the level of the base flood.

> ***Note 1: Before commencing digging, Massachusetts state law requires advance notice of at least 72 hours in Massachusetts (excluding weekends and holidays) before you get ready to begin your outdoor project. One call to Dig Safe is all it takes to notify all member utility companies of your excavation project. In turn, these utilities respond to the work area and mark the location of their underground facilities. Callers are given a permit number as confirmation. Before digging, first call "Dig Safe" (1-888-DIG-SAFE).***
>
> ***Note 2: Proposed grading activity in and around wetlands and other areas subject either to the requirements of M.G.L. c. 131, § 40 or certain Department of Environmental Protection regulations must also conform to such other requirements.***

780 CMR 120.J102 DEFINITIONS

120.J102.1 Definitions. For the purposes of 780 CMR 120.J, the terms, phrases and words listed in 780 CMR 120.J102 and their derivatives shall have the indicated meanings.

BENCH. A relatively level step excavated into earth material on which fill is to be placed.

COMPACTION. The densification of a fill by mechanical means.

CUT. See Excavation.

DOWN DRAIN. A device for collecting water from a swale or ditch located on or above a slope, and safely delivering it to an approved drainage facility

EROSION. The wearing away of the ground surface as a result of the movement of wind, water or ice.

EXCAVATION. The removal of earth material by artificial means, also referred to as a cut.

FILL. Deposition of earth materials by artificial means.

GRADE. The vertical location of the ground surface.

GRADE, EXISTING. The grade prior to grading.

GRADE, FINISHED. The grade of the site at the conclusion of all grading efforts.

GRADING. An excavation or fill or combination thereof.

KEY. A compacted fill placed in a trench excavated in earth material beneath the toe of a slope.

All slope references in the chapter have been modified to show the horizontal:vertical relationship.

SLOPE. An inclined surface, the inclination of which is expressed as a ratio of horizontal distance to vertical distance.

TERRACE. A relatively level step constructed in the face of a graded slope for drainage and maintenance purposes.

780 CMR 120.J103 PERMITS REQUIRED

120.J103.1 Permits Required. Except as exempted in 780 CMR 120.J103.2, no grading directly associated with building/structure construction/ reconstruction/repair/demolition shall be performed without first having obtained a permit therefor from the building official. ***A grading permit does not include the construction of retaining walls or other structures – a separate permit for retaining wall systems is required where retaining walls are large enough to require a building permit (see 780 CMR 110).***

120.J103.2 Exemptions. A grading permit shall not be required for the following:

1. Grading in an isolated, self-contained area, provided there is no danger to the public, and that such grading will not adversely affect adjoining properties.
2. Excavation for construction of a structure

permitted under 780 CMR.

3. Cemetery graves.

4. Refuse disposal sites controlled by other regulations.

5. Excavations for wells, or trenches for utilities.

6. Mining, quarrying, excavating, processing or stockpiling rock, sand, gravel, aggregate or clay controlled by other regulations, provided such operations do not affect the lateral support of, or significantly increase stresses in, soil on adjoining properties.

*7. Exploratory excavations performed under the direction of a registered design professional "Exploratory excavation" is not to be construed as allowing construction of a building to begin prior to receiving a permit for the sole purpose of preparing a soils report.*1

8. Grading not directly associated with building or structure construction / reconstruction / repair / demolition regulated by 780 CMR.

Exemption from the permit requirements of 780 CMR 120.J shall not be deemed to grant authorization for any work to be done in any manner in violation of the provisions of 780 CMR or any other laws or ordinances of this jurisdiction.

780 CMR 120.J104 PERMIT APPLICATION AND SUBMITTALS

120.J104.1 Submittal Requirements. In addition to the provisions of 780 CMR 105.3, the applicant shall state the estimated quantities of excavation and fill.

120.J104.2 Site Plan Requirements. In addition to the provisions of 780 CMR 106, a grading plan shall show the existing grade and finished grade in contour intervals of sufficient clarity to indicate the nature and extent of the work and show in detail that it complies with the requirements of 780 CMR. Drafting requirements were deleted here. The plans shall show the existing grade on adjoining properties in sufficient detail to identify how grade changes will conform to the requirements of 780 CMR.

120.J104.3 Soils Report. A soils report prepared by registered design professionals shall be provided which shall identify the nature and distribution of existing soils; conclusions and recommendations for grading procedures; soil design criteria for any structures or embankments required to accomplish the proposed grading; and, where necessary, slope stability studies, and recommendations and conclusions regarding site geology.

Exception: A soils report is not required where the building official determines that the nature of the work applied for is such that a report is not necessary.

120.J104.4 Liquefaction Study. For sites with mapped maximum considered earthquake spectral response accelerations at short periods (S_s) greater than 0.5g as determined by 780 CMR 1615, a study of the liquefaction potential of the site shall be provided, and the recommendations incorporated in the plans – ***note that seismic evaluation is not required for one- and two-family detached dwellings.***

Exception: A liquefaction study is not required where the building official is provided with acceptable technical evidence, determined by a design professional (Massachusetts registered architect or engineer) that determines from established local data that the liquefaction potential is low.

780 CMR 120.J105 INSPECTIONS

120.J105.1 General. Inspections shall be governed by 780 CMR 109.

120.J105.2 Special Inspections. The special inspection requirements of 780 CMR 1704.7 shall apply to work performed under a grading permit where required by the building official.

780 CMR 120.J106 EXCAVATIONS

120.J106.1 Maximum Slope. The slope of cut surfaces shall be no steeper than is safe for the intended use, and shall be no steeper than two horizontal to one vertical (50%) unless the applicant furnishes a soils report justifying a steeper slope.

Exceptions:

1. A cut surface may be at a slope of 1.5 horizontal to one vertical (67%) provided that all the following are met:
   - 1.1. It is not intended to support structures or surcharges.
   - 1.2. It is adequately protected against erosion.
   - 1.3. It is no more than eight feet (2438 mm) in height.
   - 1.4. It is approved by the building official.
2. A cut surface in bedrock shall be permitted to be at a slope of one horizontal to one vertical (100%).

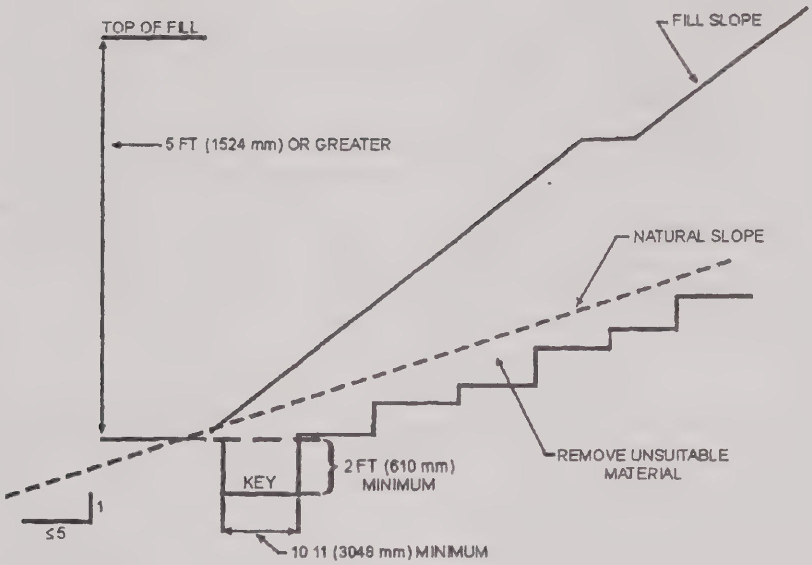
780 CMR 120.J107 FILLS

120.J107.1 General. Unless otherwise recommended in the soils report, fills shall conform to provisions of 780 CMR 120.J107.

120.J107.2 Surface Preparation. The ground surface shall be prepared to receive fill by removing vegetation, topsoil and other unsuitable materials, and scarifying the ground to provide a bond with the fill material.

120.J107.3 Benching. Where existing grade is at a slope steeper than five horizontal to one vertical (20 percent) and the depth of the fill exceeds five feet (1524 mm) benching shall be provided in accordance with Figure 780 CMR 120.J107.3. A key shall be provided which is at least ten feet (3048 mm) in width and two feet (610 mm) in depth.

Figure 780 CMR 120.J107.3
BENCHING DETAILS



For SI: one foot = 304.8 mm

120.J107.4 Fill Material. Fill material shall not include organic, frozen or other deleterious materials. No rock or similar irreducible material greater than 12 inches (305 mm) in any dimension shall be included in fills.

120.J107.5 Compaction. All fill material shall be compacted to 90% of maximum density as determined by ASTM D1557, Modified Proctor, in lifts not exceeding 12 inches (305 mm) in depth.

120.J107.6 Maximum Slope. The slope of fill surfaces shall be no steeper than is safe for the intended use. Fill slopes steeper than two horizontal to one vertical (50%) shall be justified by soils reports or engineering data.

780 CMR 120.J108 SETBACKS

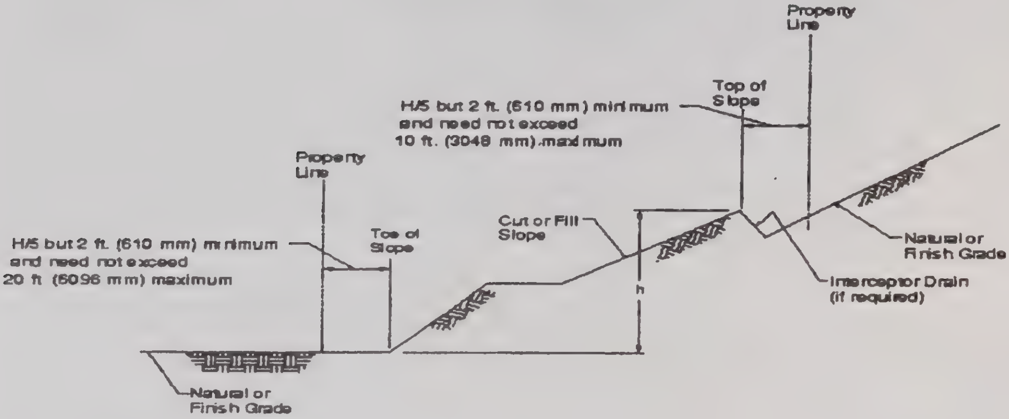
120.J108.1 General. Cut and fill slopes shall be set back from the property lines in accordance with 780 CMR 120.J108. Setback dimensions shall be measured perpendicular to the property line and shall be as shown in Figure 780 CMR J108.1, unless substantiating data is submitted justifying reduced setbacks.

120.J108.2 Top of Slope. The setback at the top of a cut slope shall not be less than that shown in Figure 780 CMR 120.J108.1, or than is required to accommodate any required interceptor drains, whichever is greater.

120.J108.3 Slope Protection. Where required to protect adjacent properties at the toe of a slope from adverse effects of the grading, additional protection, approved by the building official, shall be included. Such protection may include but shall not be limited to:

1. Setbacks greater than those required by Figure 780 CMR 120.J108.1.
2. Provisions for retaining walls or similar construction.
3. Erosion protection of the fill slopes.
4. Provision for the control of surface waters.

Figure 780 CMR 120.J108.1
DRAINAGE DIMENSIONS


Property Line
H/5 but 2 ft. (610 mm) minimum and need not exceed 10 ft. (3048 mm) maximum
Top of Slope
Property Line
H/5 but 2 ft. (610 mm) minimum and need not exceed 20 ft (6096 mm) maximum
Toe of Slope
Cut or Fill Slope
h
Natural or Finish Grade
Interceptor Drain (if required)
Natural or Finish Grade

For SI: One foot - 304.8 mm

780 CMR 120.J109 DRAINAGE AND TERRACING

120.J109.1 General. Unless otherwise recommended by a registered design professional, drainage facilities and terracing shall be provided in accordance with the requirements of 780 CMR 120.J109.

> **Exception:** Drainage facilities and terracing need not be provided where the ground slope is not steeper than three horizontal to one vertical (33%).

120.J109.2 Terraces. Terraces at least six feet (1829 mm) in width shall be established at not more than 30-foot (9144 mm) vertical intervals on all cut or fill slopes to control surface drainage and debris. Suitable access shall be provided to allow for cleaning and maintenance.

Where more than two terraces are required, one terrace, located at approximately mid-height, shall be at least 12 feet (3658 mm) in width.

Swales or ditches shall be provided on terraces. They shall have a minimum gradient of 20 horizontal to one vertical (5%) and shall be paved with concrete not less than three inches (76 mm) in thickness, or with other materials suitable to the application. They shall have a minimum depth of 12 inches (305 mm) and a minimum width of five feet (1524 mm).

A single run of swale or ditch shall not collect runoff from a tributary area exceeding 13,500 square feet (1256 m^2) (projected) without discharging into a down drain.

120.J109.3 Interceptor Drains. Interceptor drains shall be installed along the top of cut slopes receiving drainage from a tributary width greater than 40 feet, measured horizontally. They shall have a minimum depth of one foot (305 mm) and a minimum width of three feet (915 mm). The slope shall be approved by the building official, but shall not be less than 50 horizontal to one vertical (2%). The drain shall be paved with concrete not less than three inches (76 mm) in thickness, or by other materials suitable to the application. Discharge from the drain shall be accomplished in a manner to prevent erosion and shall be approved by the building official.

120.J109.4 Drainage Across Property Lines. Drainage across property lines shall not exceed that which existed prior to grading. Excess or concentrated drainage shall be contained on site or directed to an approved drainage facility. Erosion of the ground in the area of discharge shall be prevented by installation of nonerosive down drains or other devices.

780 CMR 120.J110 EROSION CONTROL

120.J110.1 General. The faces of cut and fill slopes shall be prepared and maintained to control erosion. This control shall be permitted to consist of effective planting.

> **Exception:** Erosion control measures need not be provided on cut slopes not subject to erosion due to the erosion-resistant character of the materials.
>
> Erosion control for the slopes shall be installed as soon as practicable and prior to calling for final inspection.

120.J110.2 Other Devices. Where necessary, check dams, cribbing, riprap or other devices or methods shall be employed to control erosion and provide safety.

780 CMR 120.J111 REFERENCED STANDARDS

ASTM D 1557-00	Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort [56,000 ft-lbs/ft^3 (2,700kN-m/m^3)]	120.J107.5

780 CMR 120.K

MANUFACTURED HOUSING USED AS DWELLINGS

780 CMR 120.K101 SCOPE

120.K101.1 General, One- and Two-family Dwellings. 780 CMR 120.K101.1, Items 1. through 3. shall be applicable only to a manufactured home used as a single ***or two-family*** dwelling unit and shall apply to the following:

1. Construction, alteration and repair of any foundation system which is necessary to provide for the installation of a manufactured home unit.
2. Construction, installation, addition, alteration, repair or maintenance of the building service equipment which is necessary for connecting manufactured homes to water, fuel, or power supplies and sewage systems ***(refer to requirements of the Specialized Codes).***
3. Alterations, additions or repairs to existing manufactured homes. The construction, alteration, moving, demolition, repair and use of accessory buildings and structures and their building service equipment shall comply with the requirements of the codes adopted by this jurisdiction ***(also refer to requirements of the Specialized Codes).***

780 CMR 120.K101.1, Items 1. through 3. shall not be applicable to the design and construction of manufactured homes and shall not be deemed to authorize either modifications or additions to manufactured homes where otherwise prohibited.

> **Exception**: In addition to ***780 CMR 120.K101.1,*** new and replacement manufactured homes to be located in flood hazard areas as established in ***780 CMR Table 5301.2(1)*** shall meet the applicable requirements of ***780 CMR 5323 and 780 CMR 120.G.***

780 CMR 120.K102 APPLICATION TO EXISTING MANUFACTURED HOMES AND BUILDING SERVICE EQUIPMENT

120.K102.1 General. Manufactured homes and their building service equipment to which additions, alterations or repairs are made shall comply with all the requirements of 780 CMR 120.K for new facilities, except as specifically provided in 780 CMR 120.K102.

120.K102.2 Additions, Alterations or Repairs. Additions made to a manufactured home shall be in accordance with the applicable requirements of 780 CMR and of the Specialized Codes.

Building permittable alterations or repairs to an existing manufactured home which are nonstructural and do not adversely affect any structural member or any part of the building or structure ***and are in compliance with*** required fire protection ***and in compliance with energy conservation requirements*** may be made with materials equivalent to those of which the manufactured home structure is constructed, subject to approval by the building official.

> ***Exception***: The installation or replacement of glass shall be ***in conformance with all energy related and safety glazing related requirements of 780 CMR***.

120.K102.3 Existing Installations. For building service equipment lawfully in existence at the time of the adoption of the applicable codes ***- see the requirements of the Specialized Codes***

120.K102.4 Existing Occupancy. Manufactured homes which are in existence at the time of the adoption of 780 CMR 120.K may have their existing use or occupancy continued if such use or occupancy was legal at the time of the adoption of 780 CMR 120.K provided such continued use is not dangerous to life, health and safety.

The use or occupancy of any existing manufactured home shall not be changed unless evidence satisfactory to the building official is provided to show compliance with all applicable provisions of the codes adopted by this jurisdiction. Upon any change in use or occupancy, the manufactured home shall cease to be classified as such within the intent of 780 CMR 120.K

120.K102.5 Maintenance. All manufactured homes and their building service equipment, existing and new, and all parts thereof shall be maintained in a safe and sanitary condition. All ***devices*** or safeguards which are required by applicable codes or by the Manufactured Home Standards shall be maintained in conformance with the code or standard under which it was installed. The owner or the owner's designated agent shall be responsible for the maintenance of manufactured homes, accessory buildings, structures and their building service equipment. To determine compliance with 780 CMR 120.K102.5, the building official may cause any manufactured home, accessory building or structure to be reinspected.

120.K102.6 Relocation. Manufactured homes which are to be relocated shall comply with the ***applicable provisions of 780 CMR 120.K.***

780 CMR 120.K201 DEFINITIONS

120.K201.1 General. For the purpose of 780 CMR 120.K, certain abbreviations, terms, phrases, words and their derivatives shall be construed as defined or specified in 780 CMR 120.K201.

ACCESSORY BUILDING. Any building or structure, or portion thereto, located on the same property as a manufactured home which does not qualify as a manufactured home as defined in 780 CMR 120.K201.

BUILDING SERVICE EQUIPMENT. Refers to the plumbing, mechanical and electrical equipment including piping, wiring, fixtures and other accessories which provide sanitation, lighting, heating ventilation, cooling, fire protection and facilities essential for the habitable occupancy of a manufactured home or accessory building or structure for its designated use and occupancy. ***(Refer also to the definitions and requirements of the Specialized Codes).***

MANUFACTURED HOME. A structure transportable in one or more sections which, in the traveling mode, is eight body feet (2438 body mm) or more in width or 40 body feet (12 192 body mm) or more in length or, when erected on site, is 320 or more square feet (30 m^2), and which is built on a permanent chassis and designed to be used as a dwelling with or without a permanent foundation when connected to the required utilities, and includes the plumbing, heating, air–conditioning and electrical systems contained therein; except that such term shall include any structure which meets all the requirements of 780 CMR 120.K201 MANUFACTURED HOME except the size requirements and with respect to which the manufacturer voluntarily files a certification required by the secretary (HUD) and complies with the standards established under 780 CMR 120.K For mobile homes built prior to June 15, 1976, a label certifying compliance to the Standard for Mobile Homes, NFPA 501, ANSI 119.1, in effect at the time of manufacture is required. For the purpose of these provisions, a mobile home shall be considered a manufactured home.

MANUFACTURED HOME INSTALLATION. Construction which is required for the installation of a manufactured home, including the construction of the foundation system, required structural connections thereto and the installation of on–site water, gas, electrical and sewer systems and connections thereto which are necessary for the normal operation of the manufactured home.

MANUFACTURED HOME STANDARDS. The Manufactured Home Construction and Safety Standards as promulgated by the United States Department of Housing and Urban Development.

780 CMR 120.K301 PERMITS

120.K301.1 Initial Installation. A manufactured home shall not be installed on a foundation system reinstalled or altered without first obtaining a permit from the building official. A separate permit shall be required for each manufactured home installation. When approved by the building official, such permit may include accessory buildings and structures and their building service ***equipment (when applicable, refer to the Specialized Codes for building service equipment requirements)*** when the accessory buildings or structures will be constructed in conjunction with the manufactured home installation.

120.K301.2 Additions, Alterations and Repairs to a Manufactured Home. A permit shall be obtained to alter, remodel, repair or add accessory buildings or structures to a manufactured home subsequent to its initial installation. Permit issuance and fees therefore shall be in conformance with the codes applicable to the type of work involved.

An addition made to a manufactured home as defined in these provisions shall comply with 780 CMR 120.K.

120.K301.3 Accessory Buildings. Except as provided in ***780 CMR 120.K301.1,*** permits shall be required for all accessory buildings and structures and their building service equipment. Permit issuance and fees therefore shall be in conformance with the codes applicable to the types of work involved.

120.K301.4 Exempted Work. A permit shall not be required for the types of work specifically exempted by the applicable codes. Exemption from the permit requirements of any of said codes shall not be deemed to grant authorization for any work to be done in violation of the provisions of said codes or any other laws or ordinances of this jurisdiction.

780 CMR 120.K302 APPLICATION FOR PERMIT

120.K302.1 Application. To obtain a manufactured home installation permit, the applicant shall first file an application in writing on a building permit form furnished by the building official for that purpose. ***Every*** such application shall:

1. Identify and describe the work to be covered by the permit for which application is made.
2. Describe the land on which the proposed work is to be done by legal description, street address or similar description that will readily identify and definitely locate the proposed building or work.
3. Indicate the use or occupancy for which the proposed work is intended.
4. Be accompanied by plans, diagrams, computations and specifications and other data as required in 780 CMR ***5110 and 5111, as applicable***.
5. Be accompanied by a soil investigation when required by ***780 CMR***.
6. State the valuation of any new building or structure or any addition, remodeling or alteration to an existing building.
7. Be signed by permittee, or permittee's authorized agent, who may be required to submit evidence to indicate such authority.
8. Give such other data and information as may be required by the building official.

120.K302.2 Plans and Specifications. See 780 CMR 5110 and 5111.

> *Exception: Where precast, interlocking panelized foundation wall systems are utilized, engineering calculations are required.*

120.K302.3 Information on plans and specifications. See 780 CMR generally and 780 CMR 5110 and 5111.

780 CMR 120.K303 PERMITS ISSUANCE

120.K303.1 Issuance. See 780 CMR 5110 and 5111.

120.K303.2 Retention of Plans. See 780 CMR 5111.

120.K303.3 Validity of Permit. See 780 CMR 5111.

120.K303.4 Expiration. See 780 CMR 5111.8

120.K303.5 Suspension or Revocation. See 780 CMR 5111.12.

780 CMR 120.K304 FEES

120.K304.1 Permit Fees. See 780 CMR 5114.

780 CMR 120.K.305 INSPECTIONS

120.K.305.1 General. See 780 CMR 5115.

120.K305.2 **Required inspections**.

120.K302.5.1 Structural Inspections for the Manufactured Home Installation. See 780 CMR 5115.2.

780 CMR 120.K306 MANUFACTURER'S INSTALLATION REQUIREMENTS

120.K306.1 **Manufacturer's Installation instructions.** The installation instructions as provided by the manufacturer of the manufactured home shall be used to determine permissible points of support for vertical loads and points of attachment for anchorage systems used to resist horizontal and uplift forces.

780 CMR 120.K307 FOUNDATION SYSTEMS

120.K307.1 General. Foundation systems designed and constructed ***for Manufactured Housing used as residential dwellings must be*** considered as a permanent ***foundations designed and placed to address frost conditions***.

120.K307.2 Foundation Design. See 780 CMR generally and 780 CMR 54.00 specifically.

120.K308 SKIRTING AND PERIMETER ENCLOSURES

120.K308.1 **Skirting and Permanent Perimeter Enclosures**. Skirting and permanent perimeter enclosures shall be installed only where specifically required by other laws or ordinances. Skirting, when installed, shall be of material suitable for exterior exposure and contact with the ground. Permanent perimeter enclosures shall be constructed of materials as required by this code for regular foundation construction.

Skirting shall be installed in accordance with the skirting manufacturer's installation instructions. Skirting shall be adequately secured to assure stability, to minimize vibration and susceptibility to wind damage, and to compensate for possible frost heave.

120.K308.2 **Retaining Walls**. Where retaining walls are used as a permanent perimeter enclosure, they shall resist the lateral displacements of soil or other materials and shall conform to 780 CMR as specified for foundation walls. Retaining walls and foundation walls shall be constructed of approved treated wood, concrete, masonry or other approved materials or combination of materials as for foundations as specified in this code. Siding materials shall extend below the top of the exterior of the retaining or foundation wall or the joint between siding and enclosure wall shall be flashed in accordance with 780 CMR.

780 CMR 120.K309 STRUCTURAL ADDITIONS

120.K309.1 **General.** Accessory buildings shall not be structurally supported by or attached to a manufactured home unless engineering calculations are submitted to substantiate any proposed structural connection.

> **Exception**: The building official may waive the submission of engineering calculations if it is found that the nature of the work applied for is such that engineering calculations are not necessary to show conformance to 780 CMR.

780 CMR 120.K310 BUILDING SERVICE EQUIPMENT

120.K310.1 **General**. ***The installation, alteration, repair, replacement, addition to or maintenance of the building service equipment within the manufactured home shall conform to regulations set forth in the applicable Specialized Codes and otherwise in accordance with the requirements of the Manufacturer of the Manufactured Home. All such work which is located outside the manufactured home shall comply with the applicable Specialized Codes.***

780 CMR 120.K311 EXITS

120.K311.1 **Site Development**. Exterior stairways and ramps which provide egress to the public way shall comply with applicable provisions of 780 CMR.

120.K311.2 **Accessory Buildings**. Every accessory building or portion thereof shall be provided with exits as required by 780 CMR.

780 CMR 120.K312 OCCUPANCY, FIRE SAFETY AND ENERGY CONSERVATION STANDARDS

120.K312.1 General. Alterations made to a manufactured home subsequent to its initial installation shall conform to the occupancy, fire–safety and energy conservation requirements set forth in the Manufactured Home Standards ***or 780 CMR when applicable.***

780 CMR 120.K313 SPECIAL REQUIREMENTS FOR FOUNDATION SYSTEMS

120.K313.1 General. 780 CMR 120.K310 is applicable only when specifically authorized by the building official and the building official is provided appropriate engineering support of intended foundation design.

780 CMR 120.K314 FOOTINGS AND FOUNDATIONS

120.K314.1 General. The capacity of individual load–bearing piers and their footings shall be sufficient to sustain all loads specified in this code within the stress limitations specified in 780 CMR. Footings, unless otherwise approved by the building official, shall be placed level on firm, undisturbed soil or an engineered fill which is free of organic material, such as weeds and grasses. Where used, an engineered fill shall provide a minimum load–bearing capacity of not less than 1,000 psf (48 kN/m^2). Continuous footings shall conform to the requirements of 780 CMR. ***780 CMR 120.K307*** shall apply to footings and foundations constructed under the provisions of 780 CMR 120.K314.

780 CMR 120.K315 PIER CONSTRUCTION

120.K315.1 General. Piers shall be designed and constructed to distribute loads evenly. Multiple section homes may have concentrated roof loads which will require special consideration. Load–bearing piers may be constructed utilizing one of the methods listed in 780 CMR 120.K315.1 Items 1. through 3. Such piers shall be considered to resist only vertical forces acting in a downward direction. They shall not be considered as providing any resistance to horizontal loads induced by wind or earthquake forces.

1. A prefabricated load–bearing device that is listed and labeled for the intended use.
2. Mortar shall comply with ASTM C 270 Type M, S or N; this may consist of one part portland cement, one–half part hydrated lime and four parts sand by volume. Lime shall not be used with plastic or waterproof cement.
3. A cast–in–place concrete pier with concrete having specified compressive strength at 28 days of 2,500 psi (17 225 kPa).

Alternate materials and methods of construction may be used for piers which have been designed by an engineer or architect licensed by the state to practice as such.

Caps and leveling spacers may be used for leveling of the manufactured home. Spacing of piers shall be as specified in the manufacturer's installation instructions, if available, or by an approved designer.

780 CMR 120.K316 HEIGHT OF PIERS

120.K313.1 General. Piers constructed as indicated in ***780 CMR 120.K316*** may have heights as follows:

1. Except for corner piers, piers 36 inches (914 mm) or less in height may be constructed of masonry units, placed with cores or cells vertically. Piers shall be installed with their long dimension at right angles to the main frame member they support and shall have a minimum cross–sectional area of 128 square inches (82 560 mm^2). Piers shall be capped with minimum four–inch (102 mm) solid masonry units or equivalent.
2. Piers between 36 and 80 inches (914 mm and 2032 mm) in height and all corner piers over 24 inches (610 mm) in height shall be at least 16 inches by 16 inches (406 mm by 406 mm) consisting of interlocking masonry units and shall be fully capped with minimum four–inch (102 mm) solid masonry units or equivalent.
3. Piers over 80 inches (2032 mm) in height may be constructed in accordance with the provisions of 780 CMR 120.K316.1., Item 2., provided the piers shall be filled solid with grout and reinforced with four continuous No. 5 bars. One bar shall be placed in each corner cell of hollow masonry unit piers or in each corner of the grouted space of piers constructed of solid masonry units.
4. Cast–in–place concrete piers meeting the same size and height limitations of 780 CMR 120.K316.1., Items 1., 2. and 3. may be substituted for piers constructed of masonry units.

780 CMR 120.K317 ANCHORAGE INSTALLATIONS

120.K317.1 Ground Anchors. Ground anchors shall be designed and installed to transfer the anchoring loads to the ground. The load–carrying portion of the ground anchors shall be installed to the full depth called for by the manufacturer's installation directions and shall extend below the established frost line into undisturbed soil.

Manufactured ground anchors shall be listed and installed in accordance with the terms of their listing and the anchor manufacturer's instructions and shall include means of attachment of ties meeting the requirements of ***780 CMR 120.K317***. Ground anchor manufacturer's installation instructions shall include the amount of preload required and load capacity in various types of soil. These instructions shall include tensioning adjustments which may be needed to prevent damage to the manufactured home, particularly damage that can be caused by frost heave. Each ground anchor shall be marked with the manufacturer's identification and listed model identification number which shall be visible after installation. Instructions shall accompany each listed ground anchor specifying the types of soil for which the anchor is suitable under the requirements of 780 CMR 120.K317

Each approved ground anchor, when installed, shall be capable of resisting an allowable working load at least equal to 3,150 pounds (14 kN) in the direction of the tie plus a 50% overload [4,725 pounds (21 kN) total] without failure. Failure shall be considered to have occurred when the anchor moves more than two inches (51 mm) at a load of 4,725 pounds (21 kN) in the direction of the tie installation. Those ground anchors which are designed to be installed so that loads on the anchor are other than direct withdrawal shall be designed and installed to resist an applied design load of 3,150 pounds (14 kN) at 40 to 50 degrees from vertical or within the angle limitations specified by the home manufacturer without displacing the tie end of the anchor more than four inches (102 mm) horizontally. Anchors designed for connection of multiple ties shall be capable of resisting the combined working load and overload consistent with the intent expressed in 780 CMR 120.K317.

When it is proposed to use ground anchors and the building official has reason to believe that the soil characteristics at a given site are such as to render the use of ground anchors advisable, or when there is doubt regarding the ability of the ground anchors to obtain their listed capacity, the building official may require that a representative field installation be made at the site in question and tested to demonstrate ground anchor capacity. The building official shall approve the test procedures.

120.K3174.2 Anchoring Equipment. Anchoring equipment, when installed as a permanent installation, shall be capable of resisting all loads as specified within 780 CMR 120.K. When the stabilizing system is designed by an engineer or architect licensed by the state to practice as such, alternative designs may be used, providing the anchoring equipment to be used is capable of withstanding a load equal to 1.5 times the calculated load. All anchoring equipment shall be listed and labeled as being capable of meeting the requirements of 780 CMR 120.K. Anchors as specified in 780 CMR may be attached to the main frame of the manufactured home by an approved $^{3}/_{16}$–inch–thick (4.76 mm) slotted steel plate anchoring device. Other anchoring devices or methods meeting the requirements of 780 CMR 120.K317 may be permitted when approved by the building official.

Anchoring systems shall be so installed as to be permanent. Anchoring equipment shall be so designed to prevent self–disconnection with no hook ends used.

120.K317.3 Resistance to Weather Deterioration. All anchoring equipment, tension devices and ties shall have a resistance to deterioration as required by 780 CMR.

120.K317.4 **Tensioning Devices**. Tensioning devices, such as turnbuckles or yoke–type fasteners, shall be ended with clevis or welded eyes.

780 CMR 120.K318 TIES, MATERIALS AND INSTALLATION

120.K318.1 General. Steel strapping, cable, chain or other approved materials shall be used for ties. All ties shall be fastened to ground anchors and drawn tight with turnbuckles or other adjustable tensioning devices or devices supplied with the ground anchor. Tie materials shall be capable of resisting an allowable working load of 3,150 pounds (14 kN) with no more than 2% elongation and shall withstand a 50% overload [4,750 pounds (21 kN)]. Ties shall comply with the weathering requirements of 780 CMR 120.K317.3. Ties shall connect the ground anchor and the main structural frame. Ties shall not connect to steel outrigger beams which fasten to and intersect the main structural frame unless specifically stated in the manufacturer's installation instructions. Connection of cable ties to main frame members shall be ⅝–inch (15.9 mm) closed–eye bolts affixed to the frame member in an approved manner. Cable ends shall be secured with at least two U–bolt cable clamps with the "U" portion of the clamp installed on the short (dead) end of the cable to assure strength equal to that required by 780 CMR 120.K318.

Wood floor support systems shall be fixed to perimeter foundation walls in accordance with provisions of 780 CMR. The minimum number of ties required per side shall be sufficient to resist the wind load stated in 780 CMR. Ties shall be evenly spaced as practicable along the length of the manufactured home with the distance from each end of the home and the tie nearest that end not exceeding eight feet (2438 mm). When continuous straps are provided as vertical ties, such ties shall be positioned at rafters and studs. Where a vertical tie and diagonal tie are located at the same place, both ties may be connected to a single anchor, provided the anchor used is capable of carrying both loadings. Multisection manufactured homes require diagonal ties only. Diagonal ties shall be installed on the exterior main frame and slope to the exterior at an angle of 40 to 50 degrees from the vertical or within the angle limitations specified by the home manufacturer. Vertical ties which are not continuous over the top of the manufactured home shall be attached to the main frame.

780 CMR 120.K316 REFERENCED STANDARDS

ASTMC 270-01a	Specification for Mortar for Unit Masonry	120.K313
NFP 501-99	Standard on Manufactured Housing	120.K201

780 CMR 120.L

MANUFACTURED BUILDINGS, MANUFACTURED BUILDING COMPONENTS AND MANUFACTURED HOUSING

(Note: *780 CMR 120.L is unique to Massachusetts*)

780 CMR 120.L101 GENERAL

120.L101.1 Scope. The provisions of 780 CMR 120.L shall govern the materials, design, manufacture, handling, storage, transportation, assembly, construction and/or installation of *manufactured buildings* and *manufactured building components* intended for installation in the Commonwealth of Massachusetts. *manufactured buildings* or *manufactured building components* shall not be installed in any jurisdiction of the Commonwealth of Massachusetts unless such *manufactured buildings* or *manufactured building components* have been approved and certified in accordance with 780 CMR 120.L, applicable provisions of 780 CMR, and the Rules and Regulations for *manufactured buildings*, *Manufactured Building Components* and *Manufactured Housing*, 780 CMR 110.R3, as listed in 780 CMR 100.00.

120.LI01.2 Manufactured Housing. See 780 CMR 120.K.

780 CMR 120.L102 DEFINITIONS

120.L102.1 General. For the purposes of 780 CMR 120.L and as used elsewhere in 780 CMR, the following words and terms shall have the meaning shown in 780 CMR 120.L.102.1

APPROVED. Approval by the State Board of Building Regulations and Standards (BBRS).

CERTIFICATION. Any manufactured building, manufactured building component or *manufactured housing* which meets the provisions of applicable codes and 780 CMR 110.R3 pursuant thereto, as listed in 780 CMR 35.00 or 100.00, which has been labeled accordingly.

CODE. 780 CMR (The Commonwealth of Massachusetts State Building Code) or specialized codes as defined in 780 CMR and as listed in 780 CMR 35.00 or 780 CMR 100.00

DEPARTMENT (DPS). The Department of Public Safety, Division of Inspections.

INSPECTION AGENCY. An independent agency, sometimes referred to as the "third-party agency," retained by the manufacturer and approved by the BBRS to perform inspections and evaluations of manufactured building systems, compliance assurance programs, *manufactured buildings* and *manufactured building components*.

INSTALLATION. The process of affixing, or assembling and affixing a manufactured building, manufactured building component or manufactured housing unit(s) on the building site, and connecting it to utilities, and/or to an existing building. Installation may also mean the connecting of two or more manufactured housing units designed and approved to be so connected for use as a dwelling.

INSTALLER OF MANUFACTURED BUILDING. An individual, who on the basis of training and experience, has been certified by a specific manufacturer of manufactured homes as competent to supervise the placement and connection required to install the manufactured homes of that manufacturer. Said certification by the manufacturer shall be in writing; additionally, the certified installer shall possess picture identification in the form of a driver's license or other picture identification acceptable to the building official.

LABEL. An approved device or seal evidencing certification in accordance with the applicable codes and rules and regulations promulgated pursuant thereto, and as listed in 780 CMR 100.R3.

LOCAL ENFORCEMENT AGENCY. A department or agency in a municipality charged with the enforcement of 780 CMR and appropriate Specialized Codes which include, but are not limited to, 248 CMR (the State Fuel Gas and Plumbing Code) and 527 CMR 12.00 (the State Electrical Code), as listed in 780 CMR 35.00.

MANUFACTURED BUILDING. Any manufactured building which has concealed elements, such as electrical, mechanical, plumbing, fire protection, insulation, and other systems affecting health and safety, and which is manufactured or assembled in accordance with 780 CMR and pertinent regulations, in manufacturing facilities, on or off the building site. Also, any manufactured building as defined above which does not have concealed elements, but which has been approved by the BBRS at the request of the manufacturer. "Manufactured building" does not mean "manufactured home."

MANUFACTURED BUILDING COMPONENT. Any manufactured subsystem, manufactured subassembly, or other manufactured system designed for use in or part of a structure having concealed elements such as electrical, mechanical, plumbing and fire protection systems and other systems affecting health and safety, including variations which are submitted as part of the building systems.

MANUFACTURED HOMES (Housing). As defined in 24 CFR, Part 3280.2; a structure, transportable in one or more sections, which in the traveling mode, is eight body feet or more in width or 40 body feet or more in length, or, when erected on site, is 320 or more square feet, and which is built on a permanent chassis and designed to be used as a dwelling with or without a permanent foundation when connected to the required utilities, and includes the plumbing, heating, air-conditioning, and electrical systems contained therein. C120 calculations used to determine the number of square feet in a structure will be based on the structure's exterior dimensions measured at the largest horizontal projections when erected on site. These dimensions will include 120.1 all expandable rooms, cabinets, and other projections containing interior space, but do not include bay windows. (See 24 CFR, Part 3280.2 for a more detailed description of manufactured homes as defined by the Department of Housing and Urban Development.)

SPECIALIZED CODE. All building codes, rules or regulations pertaining to building construction, reconstruction, alteration, repair, or demolition promulgated by and under the authority of the various agencies which have been authorized from time to time by the General Court of the Commonwealth of Massachusetts. The Specialized Codes shall include, but are not limited to, 248 CMR (the State Fuel Gas and Plumbing Code) and 527 CMR 12.00 (the Electrical Code), as listed in 780 CMR .35.00 or 780 CMR 100.00.

780 CMR 120.L103 CONSTRUCTION DOCUMENTS

120.LI03.1 Building System Plans. The building system plans shall show in sufficient detail the approved system to which the manufactured building or building component was produced; including foundation connection details, component connection details, emergency escape window locations and sizes, structural design loads, the manufacturer's data plate, the location of all labels required of 780 CMR 120.L and 780 CMR 110.R3, and other details as may be required by the Division of Inspection. The building system plan shall bear evidence of the approval of the Division of Inspection and evidence of third-party engineering review.

780 CMR 120.L104 APPROVAL

120.LI04.1 General. The Commonwealth of Massachusetts, Department of Public Safety, Division of Inspection (hereinafter referred to as the "Division of Inspection" in 780 CMR 120.L) shall evaluate *manufactured buildings* and building components and recommend approval to the BBRS of those which it determines to be in compliance with applicable sections of 780 CMR 120.L, other applicable sections of 780 CMR, and 780 CMR 110.R3, as listed in 780 CMR 35.00 or 780 CMR 100.00.

All approvals of plumbing, electrical or gas systems shall be made by the appropriate state agencies having jurisdiction, as specified in 780 CMR 110.R3, as listed in 780 CMR 35.00 or 780 CMR 100.00

120.L104.2 Approved Tests. The Division of Inspection may utilize the results of approved tests to determine whether a manufactured building or manufactured building component meets the requirements of 780 CMR 120.L and the 780 CMR 110.R3 as listed in 780 CMR 35.00 or 780 CMR 100.00, if that determination cannot be made from evaluation of plans, specifications and documentation alone.

120.LI04.3 Approval of Compliance Assurance Programs. The Division of Inspection shall evaluate manufacturers' compliance assurance programs and make recommendations for approval to the BBRS of those which it determines to be in compliance with 780 CMR 120.L and 780 CMR 110.R3, listed in 780 CMR 35.00 or 780 CMR 100.00.

120.LI04.4 Authorization to Vary. A manufactured building, manufactured building component or a compliance assurance program approved in accordance with 780 CMR 120.L103.3, shall not be varied in any way without prior authorization by the BBRS in accordance with 780 CMR 110.R3, as listed in 780 CMR 35.00 or 780 CMR 100.00.

780 CMR 120.L105 CERTIFICATION

120.L105.l Labeling. Any manufactured building or manufactured building component heretofore approved, in accordance with 780 CMR 120.L104, shall have an approved device or seal affixed as certification of such approval.

780 CMR 120.L106 RECIPROCITY

120.LI06.1 General. If the BBRS finds that the standards for manufacture and inspection of *manufactured buildings* or *manufactured building components* prescribed by the statutes or the rules and regulations of another state or other governmental agency meet the objectives of 780 CMR 120.L and 780 CMR 110.R3, listed in 780 CMR 35.00 or 780 CMR 100.00, and such standards are enforced satisfactorily by such other state or governmental agency or by its agents, the BBRS may grant approval and the Division of Inspection shall accept all *manufactured buildings* or *manufactured building components* which have been approved in accordance with 780 CMR 120.L106 by such other state or governmental agency and shall insure that the product is properly labeled.

120.L106.1.1 Condition of Reciprocity. The standards of another state shall not be deemed to be satisfactorily enforced unless such other state provides for notification to the BBRS of suspensions or revocations of approvals issued by that state, in a manner satisfactory to the BBRS.

120.LI06.2 Suspension of Reciprocal Approval. Upon recommendation from the Division of Inspection, the BBRS shall suspend or cause to be suspended reciprocal approval for the following reasons:

1. Determination that the standards for the manufacture and inspection of such *manufactured buildings* or *manufactured building components* of another state or other governmental agency do not meet the objectives of 780 CMR 120.L and 780 CMR 110.R3, listed in 780 CMR 100.00, or that the standards are not being enforced to the satisfaction of the Division of Inspection or BBRS; and
2. If another state or governmental agency, or its agent, suspends or revokes said approval, the approval granted under 780 CMR 120.L106.2 shall be suspended or revoked accordingly.

780 CMR 120.L107 ASSURANCE INSPECTION

120.L107.1 General. Any person or firm producing *manufactured buildings* or *manufactured building components* applying for certification shall agree in writing that the Division of Inspection or the BBRS has the right to conduct unannounced inspections at any reasonable time.

120.LI07.2 Responsibilities of Division of Inspection. The Division of Inspection shall carry out the following responsibilities:

1. Periodically make, or cause to be made, inspections of the entire process of the production of *manufactured buildings* or *manufactured building components* in order to verify the reliability of the compliance assurance program and of the approved inspection agency.
2. In addition to other on-site inspection provided for in 780 CMR 120.L107.2, the Division of Inspection shall inspect, or cause to be inspected, certified *manufactured buildings* or *manufactured building components* which it determines to have been sufficiently damaged after certification to warrant such action with regard to such *manufactured buildings* or *manufactured building components* as is authorized hereof, or as is otherwise necessary to eliminate dangerous conditions.

Note: An inspection entailing disassembly, damage to or destruction of certified *manufactured buildings* or *manufactured building components* shall not be conducted except to implement the provisions of 780 CMR 120.L.

780 CMR 120.L 108 RESPONSIBILITY OF THE LOCAL ENFORCEMENT AGENCIES

120.LI08.1 Issuance of Building Permits. Upon application and in conformity with the provisions of 780 CMR, the building official shall issue building permits for installation of certified *manufactured buildings*, *manufactured building components* or *manufactured housing*.

120.LI08.1.1 Licensed Construction Supervisors and Certified Installers. A construction supervisor, duly licensed in accordance with 780 CMR 110.R5, shall, in accordance with 780 CMR 108.3.5 of the *Sixth Edition of the Massachusetts State Building Code*, act as the agent for the owner for the purpose of applying for and obtaining any and all building permits required for the field erection of all one- or two-family manufactured dwellings subject to the provisions of 780 CMR 120.L and applicable 780 CMR 110.R3.

As part of the building permit application process, the licensed construction supervisor shall submit to the building official, in writing, the name of the installer, who shall be duly certified by the manufacturer to install said manufacturer's product, and is identified as a certified installer of *manufactured buildings* (certified installer) by said manufacturer. The certified installer shall be responsible for the safe and proper placement and connection of the manufactured home units in accordance with 780 CMR 120.L, 780 CMR 110.R3 and specialized codes as listed in 780 CMR 35.00 or 780 CMR 100.00.

The licensed construction supervisor shall be responsible for the construction of the foundation system, and all pertinent site work, in accordance with 780 CMR 120.L and 780 CMR 110.R3 listed in 780 CMR 110.00. The licensed construction supervisor shall provide at least 48 hours notice to the building official before the placement and connection of such units shall begin.

120.LI08.2 Inspection. The local enforcement agency shall make the following inspections:

1. The site preparation work, including foundations, installation of any certified *manufactured buildings* or *manufactured building components* or approved homes; and for all utility service connections, including plumbing, electrical, gas, water and sewer; for compliance with the applicable codes.
2. Inspect all certified *manufactured buildings* or *manufactured building components* or approved manufactured homes upon, or promptly after, installation at the building sites to determine whether all applicable instructions or conditions have been followed. This may include tests for tightness of plumbing and mechanical systems, for malfunctions in the electrical system, and a visual inspection for obvious violations of

780 CMR 110.R3. Destructive disassembly of certified *manufactured buildings* or *manufactured building components* or approved manufactured homes shall not be performed in order to conduct such inspections. Nondestructive disassembly may be performed only in accordance with 780 CMR 110.R3.

> **Note**: Notification to the BBRS. When any local enforcement agency finds a violation or suspects a violation exists, said violation or suspected violation shall be reported to the BBRS in accordance with 780 CMR 110.R3.5.6.

120.LI08.3 Issuance of Certificates of Occupancy. The building official shall issue a certificate of occupancy for all certified *manufactured buildings* or approved manufactured homes that have been installed and inspected and that meet the requirements of 780 CMR.

780 CMR 120.L 109 SUSPENSION OR REVOCATION OF CERTIFICATION

120.L109.1 General. The Board shall suspend or revoke the approval of any manufactured building or manufactured building component which does not comply with the provisions of 780 CMR 120.L, 780 CMR generally or 780 CMR 110.R3.

120.LI09.2 Labels of Certification. The Division of Inspection shall remove or cause to be removed the label of certification from any such manufactured building or building component not in compliance until such time as it is brought into compliance with 780 CMR 120.L and 780 CMR 110.R3.

120.LI09.3 Notice of Suspension or Revocation. Notice shall be submitted in writing to the affected parties stating the reason for the suspension or revocation.

120.LI09.4 Appeals Procedure. All appeals from suspension or revocation shall be heard by the State Building Code Appeals Board as specified in the pertinent provisions of 780 CMR 122 or 780 CMR 5122.0

780 CMR 120.M

SWIMMING POOLS, SPAS AND HOT TUBS

780 CMR 120.M101 GENERAL

120.M101.1 General. The provisions of 780 CMR 120.M shall control the design and construction of swimming pools, spas and hot tubs.

> ***Note 1:** Public and semi-public outdoor in-ground swimming pool enclosures shall conform to the requirements of M.G.L. c. 140, § 206.*
>
> ***Note 2:** Also see 521 CMR 19.00: Recreational Facilities.*
>
> ***Note 3:** Also see 105 CMR 430.000 and 435.000 as such regulates swimming pool requirements.*
>
> ***Note 4:** Installation of electrical wiring and electrical devices shall be in accordance with 527 CMR 12.00: Massachusetts Electrical Code.*
>
> ***Note 5.** Installation of gas-fired pool heaters shall be in accordance with 248 CMR (the Massachusetts Fuel Gas and Plumbing Code).*

780 CMR 120.M102 DEFINITIONS

120.M102.1 General. For the purposes of 780 CMR 120.M, the terms used shall be defined as follows and as set forth in 780 CMR 52.00.

ABOVE–GROUND/ON–GROUND POOL. See "Swimming Pool."

BARRIER. A fence, wall, building wall or combination there–of which completely surrounds the swimming pool and obstructs access to the swimming pool.

HOT TUB. See "Swimming Pool."

IN–GROUND POOL. See "Swimming Pool."

RESIDENTIAL. That which is situated on the premises of a detached one– or two–family dwelling or a one–family town–house not more than three stories in height.

SPA, NONPORTABLE. See "Swimming Pool."

SPA, PORTABLE. A nonpermanent structure intended for recreational bathing, in which all controls, water–heating and water–circulating equipment are an integral part of the product.

SWIMMING POOL. Any structure intended for swimming or recreational bathing that contains water over 24 inches (610 mm) deep. This includes in–ground, aboveground and on–ground swimming pools, hot tubs and spas.

SWIMMING POOL, INDOOR. A swimming pool which is totally contained within a structure and surrounded on all four sides by walls of said structure.

SWIMMING POOL, OUTDOOR. Any swimming pool which is not an indoor pool.

780 CMR 120.M103 SWIMMING POOLS

120.M103.1 In–ground Pools. In–ground pools shall be designed and constructed in conformance with ANSI/NSPI–5 as listed in 780 CMR 120.M107.

120.M103.2 Above–ground and On–ground Pools. Above–ground and on–ground pools shall be designed and constructed in conformance with ANSI/NSPI–4 as listed in 780 CMR 120.M107.

780 CMR 120.M104 SPAS AND HOT TUBS

120.M104.1 Permanently Installed Spas and Hot Tubs. Permanently installed spas and hot tubs shall be designed and constructed in conformance with ANSI/NSPI–3 as listed in 780 CMR 120.M107.

120.M104.2 Portable Spas and Hot Tubs. Portable spas and hot tubs shall be designed and constructed in conformance with ANSI/NSPI–6 as listed in 780 CMR 120.M107.

780 CMR 120.M105 BARRIER REQUIREMENTS

120.M105.1 Application. The provisions of 780 CMR 120.M shall control the design of barriers for residential swimming pools, spas and hot tubs. These design controls are intended to provide protection against potential drowning and near–drowning by restricting access to swimming pools, spas and hot tubs.

120.M105.2 Outdoor Swimming Pool. An outdoor swimming pool, including an in–ground, aboveground or on–ground pool, hot tub or spa shall be provided with a barrier which shall comply with the following:

1. The top of the barrier shall be at least 48 inches (1219 mm) above grade measured on the side of the barrier which faces away from the swimming pool. The maximum vertical clearance between grade and the bottom of the barrier shall be two inches (51 mm) measured on the side of the barrier which faces away from the swimming pool. Where the top of the pool structure is above grade, such as an aboveground pool, the barrier may be at ground level, such as the pool structure, or mounted on top of the pool structure. Where the barrier is mounted on top of the pool structure, the maximum vertical clearance between the top of the pool structure and the bottom of the barrier shall be four inches (102 mm).

2. Openings in the barrier shall not allow passage of a four–inch–diameter (102 mm) sphere.

3. Solid barriers which do not have openings, such as a masonry or stone wall, shall not contain indentations or protrusions except for normal construction tolerances and tooled masonry joints.

4. Where the barrier is composed of horizontal and vertical members and the distance between the tops of the horizontal members is less than 45 inches (1143 mm), the horizontal members shall be located on the swimming pool side of the fence. Spacing between vertical members shall not exceed 1.75 inches (44 mm) in width. Where there are decorative cutouts within vertical members, spacing within the cutouts shall not exceed 1.75 inches (44 mm) in width.

5. Where the barrier is composed of horizontal and vertical members and the distance between the tops of the horizontal members is 45 inches (1143 mm) or more, spacing between vertical members shall not exceed four inches (102 mm). Where there are decorative cutouts within vertical members, spacing within the cutouts shall not exceed 1.75 inches (44 mm) in width.

6. Maximum mesh size for chain link fences shall be a 2.25–inch (57 mm) square unless the fence is provided with slats fastened at the top or the bottom which reduce the openings to not more than 1.75 inches (44 mm).

7. Where the barrier is composed of dimensional members, such as a lattice fence, the maximum opening formed by the dimensional members shall not be more than 1.75 inches (44 mm).

8. Access gates shall comply with the requirements of 780 CMR 120.M105.2, Items 1 through 7, and shall be equipped to accommodate a locking device. Pedestrian access gates shall open outward away from the pool and shall be self–closing and have a self–latching device. Gates other than pedestrian access gates shall have a self–latching device. Where the release mechanism of the self–latching device is located less than 54 inches (1372 mm) from the bottom of the gate, the release mechanism and openings shall comply with the following:

   8.1. The release mechanism shall be located on the pool side of the gate at least three inches (76 mm) below the top of the gate, and

   8.2. The gate and barrier shall have no opening greater than 0.5 inch (12.7 mm) within 18 inches (457 mm) of the release mechanism.

9. Where a wall of a dwelling serves as part of the barrier one of the following conditions shall be met:

   9.1. The pool shall be equipped with a powered safety cover in compliance with ASTM F1346; or

   9.2. All doors with direct access to the pool through that wall shall be equipped with an alarm which produces an audible warning when the door and its screen, if present, are opened. The alarm shall sound continuously for a minimum of 30 seconds immediately after the door is opened and be capable of being heard throughout the house during normal house–hold activities. The alarm shall automatically reset under all conditions. The alarm system shall be equipped with a manual means, such as touchpad or switch, to temporarily deactivate the alarm for a single opening. Such deactivation shall last for not more than 15 seconds. The deactivation switch(es) shall be located at least 54 inches (1372 mm) above the threshold of the door; or

   9.3. Other means of protection, such as self–closing doors with self–latching devices, which are approved by the governing body, shall be acceptable so long as the degree of protection afforded is not less than the protection afforded by 780 CMR 120.M105.2., Item 9.1 or 9.2.

10. Where an aboveground pool structure is used as a barrier or where the barrier is mounted on top of the pool structure, and the means of access is a ladder or steps, then:

   10.1. The ladder or steps shall be capable of being secured, locked or removed to prevent access, or

   10.2. The ladder or steps shall be surrounded by a barrier which meets the requirements of 780 CMR 120.M105.2., Items 1 through 9. When the ladder or steps are secured, locked or removed, any opening created shall not allow the pass 120.Me of a four–inch–diameter (102 mm) sphere.

Note that for private, above ground pools:

   1. The pool wall of an outdoor, above-ground pool (with pool walls extending at least 48 inches above grade at all points along the pool), substitutes for a fence or other barrier around the pool with the exception of the ladder area of the pool.

   2. A retractable, lockable ladder, that cannot be removed (without tools or special knowledge available to a small child), which retracts, by hinge or sliding mechanism, to 48 inches or more above the finished grade level and has provision for securing in the retracted mode with a locking device, shall be considered an acceptable alternative to the applicable required enclosure (fence or other gate barrier) of the 780 CMR 421 (6th Edition Building Code), or 780 CMR 120.M (7th Edition Building Code for One- and Two-Family Dwellings).

   3. The retractable ladder locking/release device must be located at least 54 inches above the finished grade level in immediate vicinity of the retractable ladder or such locking/release mechanism shall be located on the pool side of the ladder (forcing

"reach around") and located at least three inches below the top of the ladder and the ladder shall not have an opening greater than ½ inch within 18 inches of the locking/release mechanism.

Exception: Public and semi-public outdoor in-ground swimming pool enclosures shall conform to the requirements of M.G.L. c. 140, § 206.

120.M105.3 Indoor Swimming Pool. All walls surrounding an indoor swimming pool shall comply with 780 CMR 120.M105.2, Item 9.

120.M105.4 Prohibited Locations. Barriers shall be located so as to prohibit permanent structures, equipment or similar objects from being used to climb the barriers.

120.M105.5 Barrier Exceptions. Spas or hot tubs with a safety cover which complies with ASTM F 1346, as listed in 780 CMR 120.M107, shall be exempt from the provisions of 780 CMR 120.M.

780 CMR 120.M106 ENTRAPMENT PROTECTION FOR SWIMMING POOL AND SPA SUCTION OUTLETS

120.M106.1 General. Suction outlets shall be designed to produce circulation throughout the pool or spa. Single outlet systems, such as automatic vacuum cleaner systems, or other such multiple suction outlets whether isolated by valves or otherwise shall be protected against user entrapment.

Note: Also refer to 105 CMR 430.000 and 435.000.

120.M106.2 Suction Fittings. All Pool and Spa suction outlets shall be provided with a cover that conforms with ANSI/ASME A112.19.8M, or a 12I 12I drain grate or larger, or an approved channel drain system.

Exception: Surface skimmers

120.M106.3 Atmospheric Vacuum Relief System Required. All pool and spa single or multiple outlet circulation systems shall be equipped with atmospheric vacuum relief should grate covers located therein become missing or broken. Such vacuum relief systems shall include at least one approved or engineered method of the type specified herein, as follows:

1. Safety vacuum release system conforming to ASME A112.19.17, or
2. An approved gravity drainage system.

120.M106.4 Dual Drain Separation. Single or multiple pump circulation systems shall be provided with a minimum of two suction outlets of the approved type. A minimum horizontal or vertical distance of three feet shall separate such outlets. These suction outlets shall be piped so that water is drawn through them simultaneously through a vacuum relief–protected line to the pump or pumps.

120.M106.5 Pool Cleaner Fittings. Where provided, vacuum or pressure cleaner fitting(s) shall be located in an accessible position(s) at least six inches and not greater than twelve inches below the minimum operational water level or as an attachment to the skimmer(s).

780 CMR 120.M107 ABBREVIATIONS

120.M107.1 General.

ANSI—American National Standards Institute
11 West 42nd Street, New York, NY 10036
ASTM—American Society for Testing and Materials
1916 Race Street, Philadelphia, PA 19103
NSPI—National Spa and Pool Institute
2111 Eisenhower Avenue, Alexandria, VA 22314

780 CMR 120.M108 STANDARDS

120.M108.1 General.

ANSI/NSPI

ANSI/NSPI–3–99 Standard for Permanently Installed Residential Spas AG104.1

ANSI/NSPI–4–99 Standard for Above-ground/ On-ground Residential Swimming Pools AG103.2

ANSI/NSPI–5–99 Standard for Residential In-ground Swimming Pools AG103.1

ANSI/NSPI–6–99 Standard for Residential Portable Spas AG104.2

ANSI/ASME A112.19.8M–1987 Suction Fittings for Use in Swimming Pools, Wading Pools, Spas, Hot Tubs and Whirlpool Bathing Appliances AG106.2

ASTM

ASTM F 1346–91 (1996) Performance Specification for Safety Covers and Labeling Requirements for All Covers for Swimming Pools, Spas and Hot Tubs AG105.2, AG105.5

ASME

ASME A112.19.17 Manufacturers Safety Vacuum Release Systems (SVRS) for Residential and Commercial Swimming Pool, Spa, Hot Tub and Wading Pool AG106.3

NON-TEXT PAGE

780 CMR 120.N

PRIVATE SEWAGE DISPOSAL

780 CMR 120.N101 GENERAL

120.N101.1 Scope. Private sewage disposal systems shall conform to 310 CMR 15.000 (Title 5 of the State Sanitary Code).

Note: For flows over 10,000 gallons see 314 CMR 5.00.

NON-TEXT PAGE

780 CMR 120.O

SOUND TRANSMISSION

780 CMR 120.O101 GENERAL

120.O101.1 General. Wall and floor-ceiling assemblies separating dwelling units shall provide airborne sound insulation for walls, and both airborne and impact sound insulation for floor-ceiling assemblies.

780 CMR 120.O102 AIR-BORNE SOUND

120.O102.1 General. Air-borne sound insulation for wall and floor-ceiling assemblies shall meet a Sound Transmission Class (STC) rating of 45 when tested in accordance with ASTM E 90.

780 CMR 120.O103 STRUCTURAL-BORNE SOUND

120.O103.1 General. Floor/ceiling assemblies between dwelling units or between a dwelling unit and a public or service area within a structure shall have an Impact Insulation Class (IIC) rating of not less than 45 when tested in accordance with ASTM E 492.

780 120.0104 REFERENCED STANDARDS

ASTM E90-99 Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements 780 CMR 120.O102

ASTM E 492-90 (1996)e Specification for Laboratory Measurement of Impact Sound Transmission through Floor-ceiling Assemblies Using the Tapping Machine 780 CMR 120.O103

NON-TEXT PAGE

780 CMR 120.P

STANDARD FORMS AND APPLICATIONS

(Note: *These forms are unique to Massachusetts*)

- State Building Code Appeals Board Application Form
- State Building Code - Code Amendment Proposal Form
- Construction Materials Safety Board Application for Approval
- State Building Code Sample Building Permit Form for One- and Two-family Dwellings
- Standard Checklist for Single- and Two-family Dwellings
- State Building Code Sample Building Permit Form for Other than One- and Two-family Dwellings
- Consumer Information Form - "Sun Rooms"
- Energy Conservation Mandatory Checklist for New Construction (Other than Low-rise Residential)
- AWC Guide to Wood Construction in High Wind Areas - Massachusetts Checklist for compliance (780 CMR 5301.2.1.1)

The Commonwealth of Massachusetts

Department of Public Safety
Board of Building Regulations and Standards
One Ashburton Place, Room 1301
Boston, Massachusetts 02108-1618
Phone (617) 727-7532
Fax (617) 227-1754

STATE BUILDING CODE APPEALS

FILING INSTRUCTIONS

Appeals are held pursuant to 801 CMR 1.02 Informal/Fair Healing Rules

BBRS\FORMS\APPEAL APPLICATION 2005

Procedures outlined on the following pages shall be followed when filing an application to appear before the Board of Building Regulations and Standards' (BBRS) Building Code Appeals Board. The Appeals Board is comprised of any three members of the BBRS. Appeals hearings are convened twice each month, generally on the first Thursday and fourth Tuesday of the month. Applications are processed on a first come, first served basis. Typically, it takes 30 to 90 days from receipt of an application to be scheduled for a hearing. Please visit our website at www.mass.gov/dps (Under "The Board of Building Regulations and Standards") for exact hearings dates and additional information about filing an appeal.

Please note that appeals hearings are intended to afford aggrieved parties with the opportunity to seek relief from the provisions of the *State Building Code* in the form of a variance or interpretation of the applicability of a particular code section. Appeals Board members are not allowed to waive code requirements in their entirety, but may consider alternative methods of complying with the intent of the code. Appeals Board members are not arbiters; rather they are professional persons representing a cross section of the building design, construction and regulatory industries who are educated in code matters. Board members will judge testimony and materials presented at a hearing based on technical merits in relation to code requirements. Appeals Board members do not have any authority to rule on zoning issues (land use issues).

Zoning requirements differ in each community. Therefore, appeals relating to land use should be directed to the Zoning Appeals Board in the city or town in which the property is located.

In order to assist with understanding the process, we have provided answers to *Frequently Asked Questions* relative to appeals procedures below.

Frequently Asked Questions About the Appeals Process

Question: What is the overall intent of the code?

Answer: The building code sets minimum standards for the design and construction of all buildings and structures in the commonwealth. The intent is to ensure that all citizens are afforded a consistent level of safety in all buildings in which they visit, live or work. A code user may choose to exceed requirements of the code, but may not design or construct to a lesser standard.

Question: What if I am not able to abide by the provisions of the code verbatim, are appeals procedures available?

Answer: The BBRS maintains an active Building Code Appeals Board which meets at least twice each month. In order to file an appeal with the State Board, a notice of violation must first be issued by the municipal or state building official charged with the enforcement of the code. This notice identifies the subject matter to be addressed at the appeal.

Once an appeal application is stamped as received by the BBRS, a stay of proceedings is enacted. This stay prevents a building official from taking further action with regard to the subject of the appeal. Also, it allows the applicant to continue to work on the project. However, please be aware that the work is continued at the applicant's risk. A stay of proceedings may not be applicable if an inspector has issued a *stop work order*.

Among other things, Appeals Board members may allow variances to provisions of the code or may offer interpretations to clarify disputes relative to a code provision. However, it is not the intent to simply waive code provisions in disregard of the public safety intent. Therefore, an applicant must demonstrate first a need for variance (if this is the intended relief) and then identify how he\she will achieve a comparable level of safety for building occupants. An applicant should always keep in mind that the code is a public safety document and that arguments relating to an appeal case should focus on issues of safety and compliance with the intent of the code; arguments should not focus on monetary savings for a project, at least not entirely.

Generally, it takes about 30 to 90 days after receipt of an application for a case to be heard. Although most cases are decided on the day of the hearing. Board members have 30 days following the hearing to issue a written decision. Technically, the decision is not finalized until the written decision is issued. Depending on complexity, cases may at times be continued and\or taken under advisement for determination at a later date.

If an appellant or other party is aggrieved by the Board's determination, he\she may request a reconsideration of the decision. Reconsideration requests must be filed in writing within ten days of receiving the written decision. It is important to note that a reconsideration may only be considered on the basis of ***new evidence***. Reconsiderations are not intended simply as a second chance to review the case. Reconsiderations are reserved for those rare instances where all facts relating to a matter may, for reason or other, not have been suitably brought forward and examined during the hearing. Reconsideration requests are required to be reviewed by Board members who originally heard the case. If a majority of Board members agree that new evidence exists, a new hearing will be scheduled. Otherwise, aggrieved parties may appeal a decision of the Board to a court of law.

Appeals procedures follow the informal\fair hearings procedures as defined in 801 CMR 1.02. Interested parties may retrieve this document by visiting www.state.ma.us/dala/801cmr.htm.

Question: Are there other reasons for filing an appeal?

Answer: An appeal may also be filed for a building official's *failure to act* on a matter. The code allows a period of 30 days for a building official to review and act on an application for permit. Technically, if a response is not received within this period an appeal may be filed on the 31st day. However, such quick action is not recommended. Like most people, building officials can get behind on their workload. If the 30 day period passes without a response, call the building official, documenting the day and time, to see if a response is forthcoming. If a response is not received via phone, try corresponding in writing, by certified mail if so desired. If these methods fail, an appeal may be filed to address the issue of the inspector's failure to act.

Procedures for Filing An Appeals Application

Please follow the instructions below when completing an Appeals Application.

1. Unless filing for a *failure to act*, the appellant must be in receipt of a denial letter from the municipal or state building official as required in Chapter 1 of the State Building Code. An appeal must be filed *within 45 days* of the date of the letter of denial. An appeal may be filed either with the local *Building Code Appeals Board*, if one has been established, or directly with the State Building Code Appeals Board. Also, an appellant may file an appeal relative to a building official's *failure to act* on his\her permit application as provided for in Chapter 1 of the State Building Code (A letter of denial is not required when filing for *failure to act).*

2. Two documents are required to be completed by the appellant or his/her representative when filing an appeal. (Each is part of this document.)

the ***Appeal Application Form*** (3 pages)
and the ***Service Notice*** (1 page).

The *Service Notice*, which gives notice to the building official that an appeal is being filed, should include the date appearing and the name and address of the building official under the section titled, "PERSON/AGENCY SERVED". The ***Method of Service*** should list one of the following procedures as set forth in Chapter I of the State Building Code for serving notice to the appropriate building inspector.

A. Personally; or
B. Registered or Certified Mail, return receipt requested; or
C. By any person authorized to serve civil process.

The ***Date of Service*** is the date when a copy of the appeal is delivered or mailed to the building official or other party entitled on the application.

The ***Service Notice*** must be signed by the appellant or his/her representative and the signature must be notarized.

The **Appeal Application Form** (2 pages) ***must be completed in total.*** The application will be reviewed for completeness prior to a hearing being scheduled. Applications determined to be incomplete will be returned to the applicant for correction. Questions relating to completing the application should be directed to your local building department or this office. Questions relating to the process may be directed to the Appeals Board Hearings Coordinator at (617) 727-3200, extension 25209.

3. ***One*** complete copy of the appeal filing, including the ***original*** **Service Notice**, must be delivered to the noted Building Official or the official entitled. ***Four*** complete copies of the appeal filing, including the original plus three copies of the **Appeal Application** form, ***four*** copies of the **Service Notice** and ***four copies*** of the denial letter, together with a check for **$150.00** (filing fee) payable to the Commonwealth of Massachusetts must be submitted to this office, if the appeal is made directly to the State Building Code Appeals Board. (Fee requirements for filing before a local Building Code Appeals Board may differ from the fees prescribed for submission to the State Building Code Appeals Board. Please check with municipal building official for these fees.).

ALL CASES WILL BE HEARD ON THE SCHEDULED DATE. POSTPONEMENTS MAY ONLY BE CONSIDERED IN EXTREME SITUATIONS WHERE SUFFICIENT NOTICE HAS BEEN PROVIDED.

The Commonwealth of Massachusetts

Department of Public Safety
Board of Building Regulations and Standards
One Ashburton Place, Room 1301
Boston, Massachusetts 02108-1618
Phone (617) 727-7532
Fax (617) 227-1754

STATE BUILDING CODE APPEAL APPLICATION FORM

DOCKET NUMBER (State Use Only)		DATE	

The undersigned hereby appeals to the State Board of Building Regulations and Standards from the decision of the following person. (Please fill-in the name of the appropriate municipal or state building inspector or other authority. Also indicate if this is a request for a ***hearing de novo*** (new hearing) relative to a decision of a municipal appeals board.)

Building Official from the City/Town of:	
Board of Appeals from the City/Town of: (Request for ***hearing de novo***)	
State Building Official:	
Other:	

Please mark the appropriate box indicating the requested action to be considered by the Appeals Board members. (More than one box may be marked.)

Variance		**Order**		**Direction**	
Interpretation		**Failure to Act**		**Other**	
STATE USE ONLY					
Fee Received					
Check Number					
Received By					

(*This section must be completed or the application will be returned.*)

Has the building or structure been the subject of an appeal by this or any other appeals board previous to this filing?

No ☐ Yes ☐ If yes, please indicate the date of the previous appeal, whether the matter was heard before a local or state appeals board, the code section that was at issue, and the specifications of the decision (*i.e.* a variance was granted\not granted).

Please take care to submit all *written* supporting documentation with this application to allow time for review. However, Board members reserve the right to continue proceedings if such material warrant extensive review.

Please provide a brief description of the desired relief below. Additional information may be attached if space is not sufficient. ***All appropriate code sections that are subject to appeal must be identified in the description.***

Please complete the following section completely and accurately.

Name of Appellant:		Representing:	
Address for Service:			
Telephone Number:		Fax Number:	
Address of Subject Property (if different from service address):			
What is appellant's connection to subject property?			

Signature of Appellant and\or Representative

Please print name legibly

Please return applications to:
Program Manager, Board of Appeals
Board of Building Regulations and Standards - One Ashburton Place, Boston, MA 1301
Boston, MA 02108-2618

DESCRIPTION OF BUILDING OR STRUCTURE RELATIVE TO THE MASSACHUSETTS STATE BUILDING CODE (780 CMR 7th EDITION): (Check as appropriate)

Do not complete the tables below for one and two family dwellings. Proceed to section entitled "Brief Description of the proposed Work".

DESCRIPTION OF PROPOSED WORK (check all applicable)

New Construction	Existing Building	Repair(s)	Alteration(s)	Addition
Accessory Bldg.	Demolition	Other Specify: ______________________		
Brief Description of Proposed Work: ______________________ ______________________ __________				

USE GROUP AND CONSTRUCTION TYPE

USE GROUP (Circle appropriate Use Group)				CONSTRUCTION TYPE	
A Assembly	A-1	A-2	A-3	1A	
	A-4	A-5		1B	
B Business				2A	
E Educational				2B	
F Factory	F-1	F-2		2C	
H High Hazard				3A	
I Institutional	I-1	I-2	I-3	3B	
M Mercantile				4	
R Residential	R-1	R-2	R-3	5A	
S Storage	S-1	S-2		5B	
U Utility	Specify: ______________________				
M Mixed Use	Specify. ______________________				
S Special Use	Specify.______________________				

COMPLETE THIS SECTION IF EXISTING BUILDING UNDERGOING RENOVATIONS, ADDITIONS AND/OR CHANGE IN USE

Existing Use Group: ______________ Existing Hazard Index (780 CMR 34): ______	Proposed Use Group: ______________ Proposed Hazard Index (780 CMR 34): ______

BUILDING HEIGHT AND AREA

BUILDING AREA	Existing (if applicable)	Proposed
Number of Floors or stories include basement levels		
Floor Area per Floor (sf)		
Total Area (sf)		
Total Height (ft)		

Brief Description of the Proposed Work:

____

____

____

STATE BUILDING CODE APPEALS BOARD
Service Notice

I, ______________________________, as ______________________________ for the

Appellant/Petitioner ______________________________ in an appeal filed with the

State Building Code Appeals Board on ______________________, 20__________

HEREBY SWEAR UNDER THE PAINS AND PENALTIES OF PERJURY THAT IN ACCORDANCE WITH THE PROCEDURES ADOPTED BY THE STATE BOARD OF BUILDING REGULATIONS AND STANDARDS AND SECTION 122.3.1 OF THE STATE BUILDING CODE, I SERVED OR CAUSED TO BE SERVED, A COPY OF THIS APPEAL APPLICATION ON THE FOLLOWING PERSON(S) IN THE FOLLOWING MANNER:

	NAME AND ADDRESS OF PERSON OR AGENCY SERVED	METHOD OF SERVICE	DATE OF SERVICE
1			
2			
3			

____
Signature: Appellant/Petitioner

On the ______________ Day of ____________________ 20_____, PERSONALLY APPEARED

BEFORE ME THE ABOVE NAMED

____
(Type or Print the Name of the Appellant)

AND ACKNOWLEDGED AND SWORE THE ABOVE STATEMENTS TO BE TRUE.

____
NOTARY PUBLIC

____
MY COMMISSION EXPIRES

Commonwealth of Massachusetts
Construction Materials Safety Board (CMSB)
Application for Approval

This form shall be used ro apply to the Construction Materials Safety Board for approval of a product, material or methodology, which is not specifically defined by the Massachusetts State Building Code.

Application Number: ______________________ Date of Application ____________________
(State Use Only)

1.0 Company Name: ______________________________

Address: ______________________________

Telephone No.: ______________________________

E-mail Address: ______________________________

Contact Person and Title: ______________________________

2.0 Name of product/material/methodology
(For products and/or materials, provide all model numbers, types, sizes, etc., for which Massachusetts approval is sought.

3.0 Description and intended use of product/material/methodology

---

4.0 If possible, identify section(s) of the Massachusetts State Building Code for which product/material/methodology approval is sought.

5.0 Information required for "end-user" of product/material/methodology (include any structural egress, fire safety, light or ventilation, energy conservation or other requirements and any limitations).

6.0 Instructions to building officials required to approve plans and inspect construction sites where applicable products/materials/methodology are utilized.

7.0 National Model Building Code Research Report Number(s) in force, if any (append actual reports to this application).

ORGANIZATION	EVALUATION REPORT NO.	EVALUATION REPORT ISSUE DATE
BOCA		
JCBO		
SBCCI		
CABO		
ICC		
OTHER		

8.0 Testing Laboratory Test Reports, if any (append actual reports to this application).

ORGANIZATION	TEST REPORT NO.	TEST REPORT ISSUE DATE
F.M.		
N.L.		
W.H.		
OTHER		

9.0 Current State/County/Municipality Approvals

JURISDICTION	APPROVAL NUMBER	APPROVAL DATE

10.0 Description and inclusion of technical information submitted to support request for approval (append actual technical information to this application)

11.0 Description and inclusion of technical information submitted to support request for approval (append actual technical information to this application)

12.0

AUTHORIZED SIGNATURE

PRINT OR TYPE AUTHORIZED NAME HERE

TITLE:

SUBMISSION DATE:

The Commonwealth of Massachusetts
State Board of Building Regulations and Standards
Massachusetts State Building Code
For One- and Two-family Dwellings

FOR MUNICIPALITY USE

APPLICATION TO CONSTRUCT, REPAIR, RENOVATE OR DEMOLISH A ONE OR TWO FAMILY DWELLING

This Section For Official Use Only

Building Permit Number: ____________________ Date Issued: ____________________

Signature: ______________________________ ____________________
Building Commissioner/Inspector of Buildings Date

SECTION 1 - SITE INFORMATION

1.1 Property Address

1.2 Assessors Map & Parcel Number:
Map Number
Parcel Number

1.3 Zoning Information:
Zoning District
Proposed Use

1.4 Property Dimensions
Lot Area (sf)
Frontage (ft)

1.5 Building Setbacks (ft)

Front Yard		Side Yards		Rear Yard	
Required	Provided	Required	Provided	Required	Provided
		/	/		

1.6 Water Supply (M.G.L. c. 40, § 54)
Public ☐ Private ☐

1.7 Flood Zone Information:
Zone:______ Outside Flood Zone ☐

1.8 Sewage Disposal System:
Municipal ☐ On site disposal system ☐

SECTION 2 - PROPERTY OWNERSHIP/AUTHORIZED AGENT

2.1 Owner of Record:
Name (Print)
Address for Service:
Signature
Telephone

2.2 Authorized Agent:
Name (Print)
Address for Service:
Signature
Telephone

SECTION 3 - CONSTRUCTION SERVICES

3.1 Licensed Construction Supervisor:
Not Applicable ☐
Licensed Construction Supervisor
License Number
Address
Expiration Date
Signature
Telephone

3.2 Registered Home Improvement Contractor:
Not Applicable ☐
Company Name
Registration Number
Address
Expiration Date
Signature
Telephone

Construction Checklist

Single- & Two Family Dwellings

If required by the building official, this form shall be submitted at the completion of the work, prior to the issuance of a certificate of occupancy or completion, by the licensed construction supervisor, registered professional or homeowner (responsible party), as applicable, the municipal and/or state building official in verification that, to the best of his/her knowledge, the work has been executed in accordance with the provisions of the applicable state building code (code) and reference standards. The date shall indicate the date on which the responsible party viewed the building activity to ensure compliance with the code and/or reference standards. This date may or may not correspond to the date on which the activity was inspected for compliance by the municipal and/or state building official.

Activity		Date	Note any deficiencies that were discovered (if any) and corrective action taken to ensure compliance with the code and/or reference standards
Foundation			
a.	Location/excavation[1]		
b.	Preparation of bearing soil		
c.	Placement of forms/reinforcing		
d.	Placement of Concrete		
e.	Setting weather protection methods		
f.	Installation of water/dampproofing		
g.	Placement of backfill		
Structural Frame[2]			
a.	Floor		
b.	Walls		
c.	Roof/ceilings		
d.	Masonry or other structural system		
Energy Conservation			
a.	Insulation/vapor and air infiltration barriers		
b.	NFRC rated window		
c.	HVAC equipment with proper efficiencies		
Fire Protection			
a.	Smoke		
b.	Heat		
c.	Carbon Monoxide		
d.	Other		
Special Construction			
a.	Chimneys		
b.	Retaining Walls		
c.	Other[3]		

1. If encountered in excavating for foundation placement, the responsible party shall report the presence of groundwater to the building official and shall submit a report detailing methods of remediation.
2. Frame shall include the installation of all joists, trusses and other structural members and sheathing materials to verify size, species and grad, spacing and attachment methods. The responsible party shall ensure that any cutting or notching of structural members is performed in accordance with the requirements of this code.
3. The building official may require the responsible party to be present on site at other points during the construction, reconstruction, alteration, removal or demolition work as he/she deems appropriate.

NOTES

In signing this form. the licensed construction supervisor, registered professional or homeowner (responsible party), as applicable attests to the fact that, to the best of his/her knowledge, the work as described on the referenced permit number and associated plans and specifications has been executed in accordance with the provisions of the applicable state building code (code) and reference standards.

Name of Responsible Party	Signature of Responsible Party

Construction Supervisor License		Home Improvement Contractor Registration		Registered Professional Engineer		Registered Architect	
Number	Expiration Date	Number	Expiration Date	Number	Expiration Date	Number	Expiration Date

This form is submitted for the following project

Permit Number	Property Address

The Commonwealth of Massachusetts
State Board of Building Regulations and Standards
Massachusetts State Building Code

FOR MUNICIPALITY USE

APPLICATION TO CONSTRUCT, REPAIR, RENOVATE, CHANGE THE USE OR OCCUPANCY OF, OR DEMOLISH ANY BUILDING OTHER THAN A ONE OR TWO FAMILY DWELLING

This Section For Official Use Only

Building Permit Number: ____________________ Date Issued: ____________________

Signature: ______________________________ ____________________
Building Commissioner/Inspector of Buildings Date

SECTION 1 - SITE INFORMATION

1.1 Property Address

____
____

1.2 Assessors Map & Parcel Number:

______________ ______________
Map Number Parcel Number

1.3 Zoning Information:

______________ ______________
Zoning District Proposed Use

1.4 Property Dimensions:

______________ ______________
Lot Area (sf) Frontage (ft)

1.5 Building Setbacks (ft)

Front Yard		Side Yards		Rear Yard	
Required	Provided	Required	Provided	Required	Provided
		/	/		

1.6 Water Supply (M.G.L. c. 40, § 54)
Public ☐ Private ☐

1.7 Flood Zone Information:
Zone:________ Outside Flood Zone☐

1.8 Sewage Disposal System:
Municipal ☐ On site disposal system ☐

SECTION 2 - PROPERTY OWNERSHIP/AUTHORIZED AGENT

2.1 Owner of Record:

______________________________ ______________________________
Name (Print) Address:
______________________________ ______________________________
Signature Telephone

2.2 Authorized Agent:

______________________________ ______________________________
Name (Print) Address:
______________________________ ______________________________
Signature Telephone

SECTION 3 - CONSTRUCTION SERVICES FOR PROJECTS LESS THAN 35,000 CUBIC FEET OF ENCLOSED SPACE

3.1 Licensed Construction Supervisor:

Not Applicable ☐

____
Licensed Construction Supervisor:
____
Address
______________________________ ______________
Signature Telephone

____
License Number
____
Expiration Date

3.2 Registered Home Improvement Contractor:

Not Applicable ☐

____
Company Name
____
Address
______________________________ ______________
Signature Telephone

____
Registration Number
____
Expiration Date

SECTION 4 - WORKERS' COMPENSATION INSURANCE AFFIDAVIT (M.G.L. c. 152 § 25C(6))

Workers Compensation Insurance affidavit must be completed and submitted with this application. Failure to provide this affidavit result in the denial of the issuance of the building permit.

Signed Affidavit Attached Yes....☐ No.....☐

SECTION 5- PROFESSIONAL DESIGN AND CONSTRUCTION SERVICES - FOR BUILDINGS AND STRUCTURES SUBJECT TO CONSTRUCTION CONTROL PURSUANT TO 780 CMR 116 (CONTAINING MORE THAN 35,000 C.F. OF ENCLOSED SPACE)

5.1 Registered Architect:

Name (Registrant):	Not Applicable ☐
Address	Registration Number
Signature Telephone	Expiration Date

5.2 Registered Professional Engineer(s):

Name	Area of Responsibility
Address	Registration Number
Signature Telephone	Expiration Date
Name	Area of Responsibility
Address	Registration Number
Signature Telephone	Expiration Date
Name	Area of Responsibility
Address	Registration Number
Signature Telephone	Expiration Date
Name	Area of Responsibility
Address	Registration Number
Signature Telephone	Expiration Date

5.3 General Contractor

Company Name:	Not Applicable ☐
Responsible In Charge of Construction	
Address	
Signature Telephone	

SECTION 6 - DESCRIPTION OF PROPOSED WORK (check all applicable)

New Construction ☐	Existing Building ☐	Repair(s) ☐	Alteration(s) ☐	Addition ☐
Accessory Bldg. ☐	Demolition ☐	Other ☐ Specify: ____________		

Brief Description of Proposed Work: ____________

____

____

____

SECTION 7 - USE GROUP AND CONSTRUCTION TYPE

USE GROUP (Check as applicable)								CONSTRUCTION TYPE	
A Assembly	☐	A-1	☐	A-2	☐	A-3	☐	1A	☐
		A-4	☐	A-5	☐			1B	☐
B Business	☐							2A	☐
E Educational	☐							2B	☐
F Factory	☐	F-1	☐	F-2	☐			2C	☐
H High Hazard	☐							3A	☐
I Institutional	☐	I-1	☐	I-2	☐	I-3	☐	3B	☐
M Mercantile	☐							4	☐
R Residential	☐	R-1	☐	R-2	☐	R-3	☐	5A	☐
S Storage	☐	S-1	☐	S-2	☐			5B	☐
U Utility	☐	Specify: ____________							
M Mixed Use	☐	Specify: ____________							
S Special Use	☐	Specify: ____________							

COMPLETE THIS SECTION IF EXISTING BUILDING UNDERGOING RENOVATIONS, ADDITIONS AND/OR CHANGE IN USE

Existing Use Group: ____________	Proposed Use Group: ____________
Existing Hazard Index 780 CMR 34): ____________	Proposed Hazard Index 780 CMR 34): ____________

SECTION 8 BUILDING HEIGHT AND AREA

BUILDING AREA	Existing (if applicable)	Proposed
Number of Floors or stories include basement levels		
Floor Area per Floor (sf)		
Total Area (sf)		
Total Height (ft)		

SECTION 9- STRUCTURAL PEER REVIEW (780 CMR 110.11)

Independent Structural Engineering Structural Peer Review Required Yes.☐.. No.....☐

SECTION 10a - OWNER AUTHORIZATION - TO BE COMPLETED WHEN OWNERS AGENT OR CONTRACTOR APPLIES FOR BUILDING PERMIT

I, ____________, as Owner of the subject property

hereby authorize ____________ to act on my be
all matters relative to work authorized by this building permit application.

____________ ____________
Signature of Owner Date

SECTION 10b - OWNER/AUTHORIZED AGENT DECLARATION

I, ______________________________, as Owner/Authorized Agent hereby declare that the statements and information on the foregoing application are true and accurate, to the best of my knowledge and belief. Signed under the pains and penalties of perjury.

____
Print Name

______________________________ ______________________________
Signature of Owner/Agent Date

SECTION 11 - ESTIMATED CONSTRUCTION COSTS

Item	Estimated Cost (Dollars) to be completed by permit applicant	Official Use Only	
1. Building		(a) Building Permit Fee Multiplier	
2. Electrical		(b) Estimated Total Cost of Construction from (6)	
3. Plumbing		**Building Permit Fee (a) x (b)**	
4. Mechanical (HVAC)			
5. Fire Protection			
6. Total = (1 + 2 + 3 + 4+ 5)		Check Number	

CONSUMER INFORMATION FORM - "SUNROOMS"

Massachusetts State Building Code (780 CMR 6101.3.2.2)

The Massachusetts State Building Code *(780 CMR)* includes provisions to ensure that houses and house additions meet energy efficiency standards. This supplemental CONSUMER INFORMATION FORM is to be filed as part of the building permit application when a builder/contractor or homeowner, constructing/installing a house addition with very large percentage of glass to opaque wall, seeks to utilize a special energy conservation exemption option for "sunroom" additions to an existing house (780 CMR, 6101.3.2.2). This FORM is not intended to prevent a homeowner from selecting a "sunroom" of any size, configuration, orientation, form of construction or percent glazing, but rather is only intended to assist homeowners in becoming aware of some of the important energy conservation and year-round comfort considerations involved in selecting and utilizing a "sunroom" addition.

The connection of "sunroom" structures to residential buildings may create comfort and energy consumption issues due to uncontrolled solar gain or uncontrolled radiation cooling of the main house. In the selection and construction/installation of "sunrooms", included below is a non-required, open-ended list of product and design considerations that a homeowner may wish to consider before actually constructing/installing a "sunroom". It is recommended that consumers carefully review these options with their designer, builder, or contractor, in order to minimize potential energy consumption and/or house discomfort issues. In addition, the qualifications and reputation of the company or individuals to be hired are important considerations.

PRODUCT AND DESIGN CONSIDERATIONS RELATED TO "SUNROOMS"

- **Solar Orientation and Natural Shading**
- **Type of Glazing**
  - **Insulating value**
  - **Solar heat gain**
  - **Frame materials**
  - **Glazing to frame sealing and gasketing materials/ seal durability and/or weather tightness of the sunroom**
- **Adequate ventilation - Operable windows and fans**
- **Applied Shading Systems**
- **Insulation level in floors, walls, and ceilings**
- **Possible Sunroom isolation from the main house via a wall and/or door or slider**
- **Heating and Cooling Methods: Efficiency, Zoning and Controls**

Homeowner Acknowledgment

The Massachusetts State Building Code, 780 CMR 6101.3.2.2, requires that the actual property owner (not the owner's agent or representative) acknowledge receipt of this CONSUMER INFORMATION FORM prior to issuance of a Building Permit for a project that includes "sunroom" additions to an existing residential building. In accordance with this requirement, the undersigned hereby acknowledges that she/he has read the information in this document concerning sunroom comfort and energy conservation.

Signature of Actual Building Owner
Date

Print Name
Address of Permitted Project

Owner Address (if different than project location)
Owner's telephone number

ENERGY CONSERVATION MANDATORY CHECKLIST FOR NEW CONSTRUCTION (OTHER THAN LOW-RISE RESIDENTIAL) 780 CMR, 1301.8.1

Owner/Agent Name: ______________________ Phone: __________

Owner/Agent Address: ______________________

City/State/Zip: ______________________

Project Name: ______________________

Site Address: ______________________ City/Town __________

Applicant's Name: ______________________ Signature: __________

Applicant's Phone: ______________________ Date of Application: __________

I. Envelope Compliance Option (check ONE)

☐ **Trade-Off** (1304.5) - Attach software Compliance Report (COMcheck-EZ)

☐ **Appendix J** (1301.2 - For buildings up to 10,000 sf only) - Attach Appendix J compliance documentation

☐ **Systems Analysis** (1309) - Attach Registered Architect's or Engineer's report

☐ **Prescriptive** (1304.2) - Complete this section, and attach copy of applicable Table (1304.2.1 through 13.4.2.12)

Climate Zone (from Table 1303.1) ☐ Zone 12a ☐ Zone 13a ☐ Zone 14a

a. Gross above-grade wall area __________sq.ft.

b. Total window & glass door area __________sq.ft.

c. Glazing % (100 x b÷a) __________% Table # utilized: __________

II. HVAC (check ONE)

☐ Simple Systems & Equipment (1305.2) ☐ Complex Systems & Equipment (1305.3)

☐ Systems Analysis (1309) - Attach Registered Architect's or Engineer's report

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III. Lighting (check ONE)

☐ Building Area Method (1308.6.2.1)
☐ Space-by-Space Method (1308.6.2.2) } Attach Compliance Documentation (COMcheck-EZ or other)
☐ Systems Analysis (1309) - Attach Registered Architect's or Engineer's report

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IV. Approval & Acceptance Construction Documents (1301.8.4.1)

Attach a narrative report describing the HVAC, Lighting, and Electric Distribution systems, including:

For Official Use ONLY:		
Building Official check off completed sections of report	☐	1. Design Intent
	☐	2. Basis of Design
	☐	3. Sequence of operation / systems interaction
	☐	4. Description of the systems (capacities, etc.)
	☐	5. Testing requirements / criteria acceptance
	☐	6. Requirement for submittal of operation manuals and maintenance manuals
	☐	7. Requirement for submittal of record drawings and control documents

This Side For Use by Building Department Only

Official's Name: ______________________ Title: ______________

I. Plans Review

Date Application Received: ______________________

☐ Complete Narrative Report Received (1301.8.4.1)

☐ Design and Specification Documents prepared by legally recognized professional (1301.8.4.3)

Application is: Approved ☐ Date: __________ Signature: ______________________

Denied ☐ Date: __________

Reason(s) for Denial: (provide additional details as needed on separate sheet)

II. Acceptance (1301.8.4.4)

☐ Successful system tests witnessed by Building Official, **OR** ☐ satisfactory test report received (check one)

☐ Certification by Registered Professional (per 780 CMR 116.2) that systems are installed in accordance with construction documents

☐ Confirmation by owner (or their authorized representative) that they have received record drawings, reviewed for reasonable accuracy

☐ Confirmation by owner (or their authorized representative) that they have received reports, controls documentation, operations manual(s), maintenance manual(s), and other documents specified in 1301.8.4.1

Building Official's Signature: ______________________________

AWC Guide to Wood Construction in High Wind Areas: 110 mph Wind Zone
Massachusetts Checklist for Compliance (780 CMR 5301.2.1.1)[1]

☑ Check Compliance

1.1 SCOPE

Wind Speed (3-sec. gust) .... 110 mph ___
Wind Exposure Category .... B ___

1.2 APPLICABILITY

Number of Stories (a roof which exceeds 8 in 12 slope shall be considered a story)
_____ stories ≤ 2 stories ___
Roof Pitch .... (Fig 2) .... _____ ≤ 12:12 ___
Mean Roof Height .... (Fig 2) .... _____ ft ≤ 33' ___
Building Width, W .... (Fig 3) .... _____ ft ≤ 80' ___
Building Length, L .... (Fig 3) .... _____ ft ≤ 80' ___
Building Aspect Ratio (L/W) .... (Fig 4) .... _______ ≤ 3:1 ___
Nominal Height of Tallest Opening[2] .... (Fig 4) .... _______ ≤ 6'8" ___

1.3 FRAMING CONNECTIONS

General compliance with framing connections . . . (Table 2) .... ___

2.1 FOUNDATION

Foundation Walls meeting requirements of 780 CMR 5404.1
Concrete .... ___
Concrete Masonry .... ___

2.2 ANCHORAGE TO FOUNDATION[1,3]

⅝" Anchor Bolts imbedded or ⅝" Proprietary Mechanical Anchors as an alternative in concrete only
Bolt Spacing – general .... (Table 4) .... _____ in. ___
Bolt Spacing from end/joint of plate .... (Fig 5) .... _____ in. ≤ 6" – 12" ___
Bolt Embedment – concrete .... (Fig 5)...... .... ___ in. ≥ 7" ___
Bolt Embedment – masonry .... (Fig 5) .... _____ in. ≥ 15" ___
Plate Washer .... (Fig 5) .... ≥ 3" x 3" x ¼" ___

3.1 FLOORS

Floor framing member spans checked .... (per 780 CMR 55.00) .... ___
Maximum Floor Opening Dimension .... (Fig 6) .... ___ ft ≤ 12' ___
Full Height Wall Studs at Floor Openings less than 2' from Exterior Wall (Fig 6) .... ___
Maximum Floor Joist Setbacks
Supporting Loadbearing Walls or Shearwall . (Fig 7) .... ___ ft ≤ d ___
Maximum Cantilevered Floor Joists
Supporting Loadbearing Walls or Shearwall . (Fig 8) .... ___ ft ≤ d ___
Floor Bracing at Endwalls .... (Fig 9) .... ___
Floor Sheathing Type .... (per 780 CMR 55.00) .... ___
Floor Sheathing Thickness .... (per 780 CMR 55.00) .... ____ in. ___
Floor Sheathing Fastening .... (Table 2) ___d nails at ____in edge / ___ in field ___

4.1 WALLS

Wall Height
Loadbearing walls .... (Fig 10 and Table 5) .... ___ ft ≤ 10' ___
Non-Loadbearing walls .... (Fig 10 and Table 5) .... ___ ft ≤ 20' ___
Wall Stud Spacing .... (Fig 10 and Table 5) .... ___ in. ≤ 24" o.c. ___
Wall Story Offsets .... (Figs 7 & 8) .... ___ ft ≤ d ___

4.2 EXTERIOR WALLS[3]

Wood Studs
Loadbearing walls .... (Table 5) .... 2x___ - ___ ft ___ in. ___
Non-Loadbearing walls .... (Table 5) .... 2x___ - ___ ft ___ in. ___
Gable End Wall Bracing[1]
Full Height Endwall Studs .... (Fig 10) .... ___
WSP Attic Floor Length .... (Fig 11) .... ___ ft ≥W/3 ___
Gypsum Ceiling Length (if WSP not used) (Fig 11) .... ___ ft ≥ 0.9W ___
and 2 x 4 Continuous Lateral Brace @ 6 ft. o.c. .. (Fig 11)........................ .... ___
or 1 x 3 ceiling furring strips @ 16" spacing min. with 2 x 4 blocking @ 4 ft. spacing in end joist or truss bays .... ___
Double Top Plate
Splice Length .... (Fig 13 and Table 6) .... ___ ft ___
Splice Connection (no. of 16d common nails)(Table 6) .... ___ ___

Loadbearing Wall Connections

Lateral (no. of 16d common nails) .... (Tables 7) .... ____ ____

Non-Loadbearing Wall Connections

Lateral (no. of 16d common nails) .... (Table 8) .... ____ ____

Load Bearing Wall Openings (record largest opening but check all openings for compliance to Table 9)

Header Spans .... (Table 9) .... ___ ft ___ in. ≤ 11' ____

Sill Plate Spans .... (Table 9) .... ___ ft ___ in. ≤ 11' ____

Full Height Studs (no. of studs) .... (Table 9) .... ____ ____

Non-Load Bearing Wall Openings (record largest opening but check all openings for compliance to Table 9)

Header Spans...... .... (Table 9) .... ___ ft ___ in. ≤ 12' ____

Sill Plate Spans.... .... (Table 9) .... ___ ft ___ in. ≤ 12" ____

Full Height Studs (no. of studs) .... (Table 9) .... ____ ____

Exterior Wall Sheathing to Resist Uplift and Shear Simultaneously[4]

Minimum Building Dimension, W

Nominal Height of Tallest Opening[2] .... ___≤ 6'8" ____

Sheathing Type .... (note 4) .... ______ ____

Edge Nail Spacing .... (Table 10 or note 4 if less) .... ____ in. ____

Field Nail Spacing .... (Table 10) .... ____ in. ____

Shear Connection (no. of 16d common nails) (Table 10) .... ___ ____

Percent Full-Height Sheathing .... (Table 10) ....___% ____

5% Additional Sheathing for Wall with Opening > 6'8" (Design Concepts) .... ____

Maximum Building Dimension, L

Nominal Height of Tallest Opening[2] .... ___≤ 6'8" ____

Sheathing Type .... (note 4) .... ______ ____

Edge Nail Spacing .... (Table 11 or note 4 if less) .... ____ in. ____

Field Nail Spacing .... (Table 11) .... ____ in. ____

Shear Connection (no. of 16d common nails) (Table 11) .... ___ ____

Percent Full-Height Sheathing .... (Table 11) ....___% ____

5% Additional Sheathing for Wall with Opening > 6'8" (Design Concepts) .... ____

Wall Cladding

Rated for Wind Speed? .... ____

5.1 ROOFS

Roof framing member spans checked? (For Rafters use AWC Span Tool, see BBRS Website) ____

Roof Overhang .... (Figure 19) ...... ___ ft ≤ smaller of 2' or L/3 ____

Truss or Rafter Connections at Loadbearing Walls

Proprietary Connectors

Uplift .... (Table 12) .... U=____ plf ____

Lateral .... (Table 12) .... L=____ plf ____

Shear .... (Table 12) .... S=____ plf ____

Ridge Strap Connections, if collar ties not used per page 21 (Table 13) .... T=____ plf ____

Gable Rake Outlooker .... (Figure 20) ...... ___ ft ≤ smaller of 2' or L/2 ____

Truss or Rafter Connections at Non-Loadbearing Walls

Proprietary Connectors

Uplift .... (Table 14) .... U=____ lb. ____

Lateral (no. of 16d common nails) .... (Table 14) .... L =____lb. ____

Roof Sheathing Type .... (per 780 CMR 58.00 and 59.00) .... ____

Roof Sheathing Thickness .... ___ in. ≥ 7/16" WSP ____

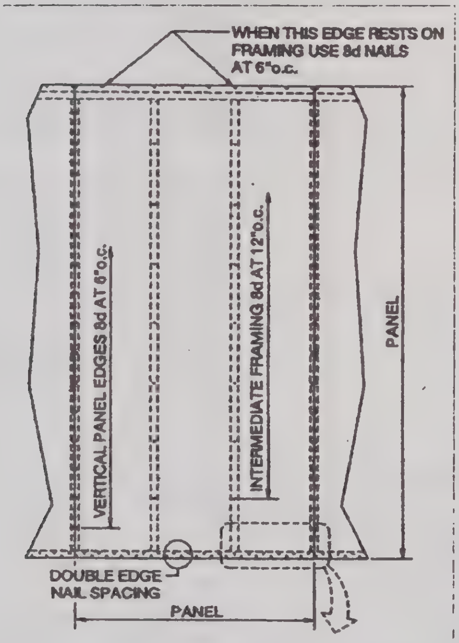
Roof Sheathing Fastening .... (Table 2) .... ___ ____

Notes:

1. This checklist shall be met in its entirety, excluding the specific exception noted in 2, to comply with the requirements of 780 CMR 5301.2.1.1 Item 1. If the checklist is met in its entirety then the following metal straps and hold downs are not required per the WFCM 110 mph Guide:
   a. Steel Straps per Figure 5
   b. 20 Gage Straps per Figure 11
   c. Uplift Straps per Figure 14
   d. All Straps per Figure 17
   e. Corner Stud Hold Downs per Figure 18a and Figure 18b
2. Exception: Opening heights of up to 8 ft. shall be permitted when 5% is added to the percent full-height sheathing requirements shown in Tables 10 and 11.
3. The bottom sill plate in exterior walls shall be a minimum 2 in. nominal thickness pressure treated #2-grade.
4. a. From Tables 10 and 11 and location of wall sheathing and Building Aspect Ratio, determine Percent Full-Height Sheathing and Nail Spacing requirements

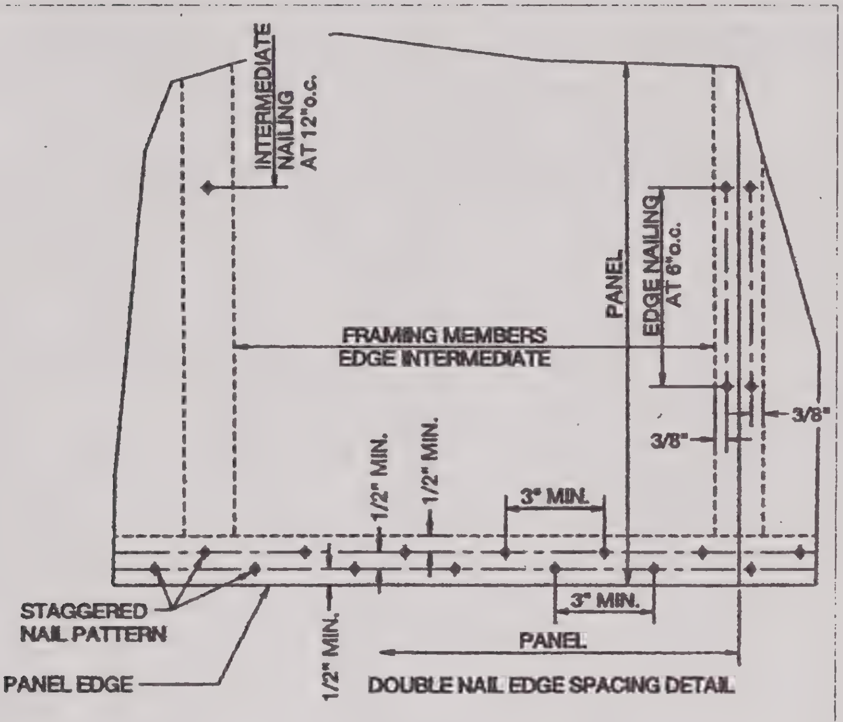
b. Wood Structural Panels shall be minimum thickness of 7/16" and be installed as follows:

  - i. Panels shall be installed with strength axis parallel to studs.
  - ii. All horizontal joints shall occur over and be nailed to framing.
  - iii. On single story construction, panels shall be attached to bottom plates and top member of the double top plate.
  - iv. On two story construction, upper panels shall be attached to the top member of the upper double top plate and to band joist at bottom of panel. Upper attachment of lower panel shall be made to band joist and lower attachment made to lowest plate at first floor framing.
  - v. Horizontal nail spacing at double top plates, band joists, and girders shall be a double row of 8d staggered at 3 inches on center per figures below : Vertical and Horizontal Nailing for Panel Attachment


WHEN THIS EDGE RESTS ON FRAMING USE 8d NAILS AT 6"o.c.
VERTICAL PANEL EDGES 8d AT 6"o.c.
INTERMEDIATE FRAMING 8d AT 12"o.c.
PANEL
DOUBLE EDGE NAIL SPACING
PANEL

See Detail on Next Page

Vertical and Horizontal Nailing for Panel Attachment


INTERMEDIATE NAILING AT 12"o.c.
PANEL
EDGE NAILING AT 6"o.c.
FRAMING MEMBERS
EDGE INTERMEDIATE
3/8"
3/8"
1/2" MIN.
1/2" MIN.
3" MIN.
3" MIN.
STAGGERED NAIL PATTERN
PANEL EDGE
1/2" MIN.
PANEL
DOUBLE NAIL EDGE SPACING DETAIL

Detail
Vertical and Horizontal Nailing
for Panel Attachment

NON-TEXT PAGE

780 CMR 120.Q

RECOMMENDED FASTENING SCHEDULE

(Note: *780 CMR 120.Q is unique to Massachusetts*)

Note: The applicable fastening schedules presented/referenced in 780 CMR 53.00 through 61.00 shall apply except that where fastening schedule information is not presented, the fastening schedule below shall then apply, unless fasteners are sized by a registered design professional.

780 CMR Table 120.Q1
RECOMMENDED FASTENING SCHEDULE

BUILDING ELEMENT	NAIL SIZE AND TYPE	NUMBER AND LOCATION
Stud to sole plate	8d common 16d common	4 toe-nail or 2 direct-nail
Stud to cap plate	16d common	2 toe-nail or 2 direct-nail
Double studs	10d common	12" o.c. direct
Corner studs	16d common	24" o.c. direct
Sole plate to joist or blocking	16d common	16" o.c.
Double cap plate	10d common	16" o.c. direct
Cap plate laps	10d common	2 direct-nail
Ribbon strip, 6" or less	10d common	2 each direct bearing
Ribbon strip, 6" or more	10d common	3 each direct bearing
Roof rafter to plate	8d common	3 toe-nail
Roof rafter to ridge	16d common	2 toe-nail or direct nail
Jack rafter to hip	10d common 16d common	3 toe-nail or 2 direct-nail
Floor joists to studs (No ceiling joists)	10d common 10d common	5 direct or 3 direct
Floor joists to studs (With ceiling joists)	10d common	2 direct
Floor joists to sill or girder	3d common	3 toe-nail
Ledger strip	16d common	3 each direct
Ceiling joists to plate	16d common	3 toe-nail
Ceiling joists (laps over partition)	10d common	3 direct-nail
Ceiling joists (parallel to rafter)	10d common	3 direct
Collar beam	10d common	3 direct
Bridging to joists	8d common	2 each direct end
Diagonal brace (to stud & plate)	8d common	2 each direct bearing
Tail beams to headers (When nailing permitted)	20d common	1 each end 4 sq. ft. floor area
Header beams to trimmers	20d common	1 each end 8 sq. ft. floor area
1" roof decking (over 6" in width)	8d common 8d common	2 ea. direct rafter 3 each direct rafter
1 " subflooring (6" or less)	8d common	2 each direct joist
1" subflooring (8" or more)	8d common	3 each direct joist
2" subflooring	16d common	2 each direct joist
1" wall sheathing (8" or less in width)	8d common	2 each direct stud
1" wall sheathing (over 8" in width)	8d common	3 each direct stud
Plywood roof & wall sheathing		
(½" or less)	6d common	6" o.c. direct edges & 12" o.c intermediate
(⅝" or greater)	8d common	6" o.c. direct edges & 12" o.c. intermediate
(5/16", ⅜", or ½")	16 gauge galvanized wire staples, ⅜" minimum crown; length of 1" plus plywood thickness	4" o.c. edges & 8" o.c. intermediate
(⅝")	Same as immediately above	2½" o.c. edges & 5" o.c. intermediate
Plywood subflooring:		
(½")	6d common or 6d annular or spiral thread	6" o.c. direct edges & 10" o.c. intermediate
(⅜", ¾")	8d common or 8d annular or spiral thread	6" o.c. direct edges & 10" o.c. intermediate
(1", 1⅛")	10d common or 8d ring shank or 8d annular or spiral thread	6" o.c. direct edges & 6" o.c. intermediate
(½")	16d galvanized wire staples	4" o.c. edges & 7" o.c. intermediate
(⅜")	⅜" minimum crown, 1⅜" length	2½" o.c. edge 4" o.c. intermediate

BUILDING ELEMENT	NAIL SIZE AND TYPE	NUMBER AND LOCATION
Built-up girders and beams	20d common	32" o.c. direct
Continuous header to stud	8d common	4 toe nail
Continuous header, two pieces	16d common	16" o.c. direct
½" fiber board sheathing	1½" galvanized roofing nail or 16 gauge staple, 1½" long with min. crown of 7/16"	3" o.c. exterior edge 6" o.c. intermediate
25/32" fiber board sheathing	1¾" galvanized roofing nail or 8d common nail or 16 gauge staple, 1½" long with min. crown of 7/16"	3" o.c. exterior edge 6" o.c. intermediate
Gypsum sheathing	12 gauge 1¾" large head corrosion-resistant	4" o.c. on edge 8" o.c. intermediate
Particle board underlayment (¼"-¾")	6d annular threaded	6" o.c. direct edges 10" o.c. intermediate
Particle board roof and wall sheathing ½" or less	6d common	6" o.c. direct edges 12" o.c. intermediate
⅝" or greater	8d common	6" o.c. direct edges 12" o.c. intermediate
Particle board subflooring (⅝" or greater)	8d common	6" o.c. direct edges 12" o.c. intermediate
Shingles, wood[a]	No. 14 B&S Gage corrosion resistive	2 each bearing
Weather boarding	8d corrosion	2 each bearing

For SI: 1 inch - 25.4 mm, 1 square foot = 0.0929m^2

Note a: Shingle nails shall penetrate not less than ¾" into nailing strips, sheathing or supporting construction except as otherwise provided in 780 CMR 1225.4.4.

780 CMR TABLE 120.Q2
MAXIMUM SPACING OF GYPSUM WALLBOARD FASTENERS
(For nonfire-resistance rated construction assemblies)

Thickness of gypsum wallboard (inch)	Plane of framing surface	Long dimension of gypsum wall-board sheets in relation to direction of framing members	Maximum spacing of framing members (center-to-center in inches)	Maximum spacing of fasteners (center-to- center in inches)		Nails to wood
				Nails	Screws	
½	Horizontal	Either direction	16	7	12	No. 13 gage, 1⅜" long, 19/54" head No. 098 gage, 1¼" long, Annular ringed 5d cooler nail
	Horizontal	Perpendicular	24	7	12	
	Vertical	Either direction	24	8	12	
⅝	Horizontal	Either direction	16	7	12	No. 13 gage, 1⅝" long, 19/64" head No .098 gage, 1⅜" long, Annual ringed 6d cooler nail
	Horizontal	Perpendicular	24	7	12	
	Vertical	Either direction	24	8	12	
Fastening required with adhesive application						
½ or ⅝	Horizontal	Either direction	16	16	16	As required for ½" and ⅝" gypsum wallboard, see above
		Perpendicular	24	12	16	
	Vertical	Either direction	24			
2 layers each ⅜" (¾" total)	Horizontal	Perpendicular	24	16	16	Base ply nailed as required for ½" gypsum wallboard and face ply placed with adhesive
	Vertical	Either direction	24	24	24	

Note a. Where the metal framing has a clinching design formed to receive the nails by two edges of metal, the nails shall be not less than ⅝ inch longer than the wallboard thickness, and shall have ringed shanks. Where the metal framing has a nailing groove formed to receive the nails, the nails shall have barbed shanks or be 5d cooler nail (No. 13 ½ gage, 1⅝ inches long, 15/64 inch head) for ½ inch gypsum wallboard; 6d cooler (No. 13 gage, 1⅞ inches long, 15/64 head) for ⅝-inch gypsum wallboard.

Note b. Two nails at 2 inches to 2½ inches apart may be used if the pairs are spaced 12 inches center-to-center except around perimeters.

Note c. Screws shall be No. 6 with tapered head and long enough to penetrate into wood framing not less than ⅝ inch and metal framing not less than ¼ inch

Note d. All nails shall meet ASTM C514 or Federal Specification FF-N-105C.

Note e. For fireresistance rated construction, see the pertinent fire test information.

Note f. 1 inch = 25.4 mm.

780 CMR TABLE 120.Q3

ALLOWABLE SHEAR FOR WIND OR SEISMIC FORCES IN POUNDS PER FOOT FOR VERTICAL DIAPHRAGMS OF LATH AND PLASTER OR GYPSUM BOARD FRAME WALL ASSEMBLIES

Type of material	Thickness of Material	Wall Construction	Nail spacing maximum (in inches)	Shear value	Minimum nail size
Gypsum lath, plain or perforated	⅜" Lath and ½" Plaster	Unblocked	5	100	No. 13 gage, 1⅛" long, 19/64" head, plasterboard blued nail.
Gypsum sheathing board	½" x 2'x 8'	Unblocked	4	75	No. 11 gage, 1¼" long, 7/64" head, diamond point, galvanized.
	½"x4'	Blocked	7		
	½"x4'	Unblocked			
Gypsum Wallboard or Veneer base			7	2e+20	5d Cooler nails
	½"	Unblocked	4		
		Blocked	7		
			4		
			4		
	⅝"	Blocked			6d cooler nails
		Two ply	Base ply 9		
					Base ply-6d cooler nails
			Face ply 7		
					Face ply-8d cooler nails

Note a. These vertical diaphragms shall not be used to resist loads imposed by masonry or concrete construction. Values are for short time loading due to wind or earthquake and must be reduced 25% for normal loading

Note b. Applies to nailing at all studs, top and bottom plates and blocking.

Note c. Values shown are for gypsum board applied to one side only. The shear values may be doubled when identical materials are applied to both sides of wall

Note d. 1 inch = 25.4 mm.

NON-TEXT PAGE

780 CMR 120.R

GUIDANCE FOR SELECTION OF FOUNDATION MATERIAL CLASSES

120.R1.1 Purpose. The purpose of 780 CMR 120.R is to provide guidance for the selection of the material class and consistency in place when using Table 1804.3, Allowable Bearing Pressures for Foundation Materials.

120.R1.2 Application. 780 CMR 120.R is provided only as a general guide to engineering judgment. All available data should be evaluated and professional engineering judgment exercised in selection of the appropriate material classification for use with Table 1804.3. The references on soil and rock classification and typical ranges of index properties provided in this appendix should not be considered to be code requirements.

120.R1.3 Classification of Soil. Guidelines for generally accepted engineering practice in the description and classification of soils are provided in ASTM D2488-84 Description and identification of Soils (Visual-Manual Procedure) and ASTM D2487-85 Classification of Soils for Engineering Purposes.

120.R1.4 Classification of Rock. Guidelines for generally accepted engineering practice in the description and classification of rocks are provided in Chapter 1 of Design Manual 7.1 - Soil Mechanics, Naval Facilities Engineering Command, May 1982 (NAVFAC DM-7.1)

120.R1.5 Typical Index Properties. Typical ranges of index properties for the Material Classes listed in Table 120.R1 are provided in Table 120.R2.

TABLE 120.R1 ALLOWABLE BEARING PRESSURES FOR FOUNDATION MATERIALS

Material Class	Description	Notes	Consistency in Place[1]	Allowable Net Bearing Pressure (tons/ft^2)
1a	Massive bedrock: Granite, diorite gabbro, basalt, gneiss	3	Hard, sound rock, minor jointing	100
1b	Quartzite, well cemented conglomerate	3	Hard, sound rock moderate jointing	60
2	Foliated bedrock: slate, schist	3	Medium hard rock, minor jointing	40
3	Sedimentary bedrock: cementation shale, siltstone, sandstone, limestone, dolomite, conglomerate	3, 4	Soft rock, moderate jointing	20
4	Weakly cemented sedimentary bedrock: compaction shale or other similar rock in sound condition	3	Very soft rock	10
5	Weathered bedrock: any of the above except shale.	3, 5	Very soft rock, weathered and/or major jointing and fracturing	8
6	Slightly cemented sand and/or gravel, glacial till (basal or lodgement), hardpan	7,8	Very dense	10
7	Gravel, widely graded sand and gravel; and granular ablation till	6, 7, 8	Very dense	8
			Dense	6
			Medium dense	4
			Loose	2
			Very loose	Note 11
8	Sands and non-plastic silty sands with little or no gravel (except for Class 9 materials)	6, 7, 8, 9	Dense	4
			Medium dense	3
			Loose	2
			Very loose	Note 11
9	Fine sand, silty fine sand, and non-plastic inorganic silt	6, 7, 9	Dense	3
			Medium dense	2
			Loose	1
			Very loose	Note 11
10	Inorganic sandy or silty clay, clayey sand, clayey silt, clay, or varved clay; low to high plasticity	5, 6, 10	Hard	4
			Stiff	2
			Medium	1
			Soft	Note 11
11	Organic soils: peat, organic silt, organic clay	11		Note 11

Notes for TABLE 120.R1:

1. Refer to 780 CMR 120.R2 regarding typical index test values that may be helpful as guides for evaluation of consistency in place.

2. Refer to 780 CMR 18.00 of the 6TH Edition Massachusetts Building Code for determination of design loads and for special cases.

3. The allowable bearing pressures may be increased by an amount equal to 10% for each foot of depth below the surface of sound rock; however, the increase shall not exceed two times the value given in the table.

4. For limestone and dolomite, the bearing pressures given are acceptable only if an exploration program performed under the direction of a registered design professional demonstrates that there are no cavities within the zone of influence of the foundations. If cavities exist, a special study of the foundation conditions is required.

5. Weathered shale and/or weathered compaction shale shall be included in Material Class 10. Other highly weathered rocks and/or residual soils shall be treated as soil under the appropriate description in Material Classes 6 to 10. Where the transition between residual soil and bedrock is gradual, a registered design professional shall make a judgment as to the appropriate bearing pressure.

6. Settlement analyses in accordance with 780 CMR 18.00 of the 6th Edition Massachusetts Building Code should be performed if the ability of a given structure to tolerate settlements is in question, particularly for, but not limited to, soft or very soft clays and silts and loose granular materials.

7. Allowable bearing pressures may be increased by an amount equal to 5% for each foot of depth of the bearing area below the minimum required in 780 CMR 18.00 of the 6th Edition Massachusetts Building Code; however, the bearing pressure shall not exceed two times the value given in the table. For foundation bearing areas having a least lateral dimension smaller than three feet, the allowable bearing pressure shall be ⅓ of the tabulated value times the least dimension in feet.

8. Refer to 780 CMR 18.00 of the 6th Edition Massachusetts Building Code when these materials are used as compacted fills.

9. These materials are subject to the provisions in 780 CMR 18.00 of the 6th Edition Massachusetts Building Code for Liquefaction).

10 Alternatively, the allowable bearing pressure may be taken as 1.5 times the peak unconfined compressive strength of undisturbed samples for square and round footings or 1.25 times that strength for footings with length to width ratio of 4 or greater. For intermediate cases, interpolation may be used.

11. A registered design professional shall be engaged to provide recommendations for these special cases. Direct bearing on organic soils is not permitted. Organic soils are allowed under foundations for those cases defined in 780 CMR 18.00 of the 6th Edition Massachusetts Building Code, Preloaded materials.

TABLE 120.R2 TYPICAL RANGE OF INDEX PROPERTIES

Material Class	Description	Consistency in Place	Rock Quality Designation (RQD %)	Unconfined Compressive Strength (PSF)	Standard Penetration Resistance (Blows/Foot)
1a	Massive bedrock - granite, diorite, gabbro, basalt, gneiss,	Hard rock, minor jointing	>75	>8000	-
1b	quartzite, well-cemented conglomerate	Hard sound rock, moderate jointing	50 to 75		
2	Folliated bedrock	Medium hard rock minor jointing	>50	>8000	-
3	Sedimentary bedrock-cementation shale, siltstone, sandstone, limestone, dolomite, conglomerate	Soft rock, moderate jointing	>50		-
4	Weakly cemented sedimentary bedrock - compaction shale or other similar rock in sound condition	Very soft rock	<50		
5	Weathered bedrock - any of the above except shale	Very soft rock. weathered and/or major jointing and fracturing	<50		-
6	Slightly cemented sand and/or gravel, glacial till (basal or lodgement), haropan	Very dense	-		>50
7	Gravel, widely graded sand and gravel, and granular abiation till	Very dense	-		>50
		Dense			41-50
		Medium dense			16-40
		Loose			8-15
		Very loose			<8
8	Sands and non-plastic silty sands with little or no gravel (except for Class 9 materials	Dense	-		>30
		Medium dense			11-30
		Loose			6-10
		Very loose			<6
9	Fine sand, silty sand and non-plastic inorganic silt	Dense	-		>30
		Medium dense			11-30
		loose			6-10
		Very loose			<6
10	Inorganic sandy or silty clay, clayey sand, clayey slit, clay or varved clay low to high plasticity	Hard	-		>20
		Stiff			9-20
		Medium			4-8
		Soft			<4
11	Organic soils - peat organic silt, organic clay	-	-		-

Notes to TABLEe 120.R2

Note 1: For discussion of RQD values see Deere, D.U., Rock Mechanics in Engineering Practice (Chapter 1), Stagg and Zinkiewicz, Eds., 1968, John Wiley and Sons, Inc.

Note 2: For determination of Unconfined Compressive Strength see ASTM D2938.

Note 3: For determination of Standard Penetration Resistance N-value see ASTM D1586. The presence of large particles (coarse gravel, cobbies, boulders) may cause N-values to be unrealistically high. Such values should not be used. Also standard penetration resistance should not be used over depths less than five feet.

NON-TEXT PAGE

780 CMR 120.S

REFERENCE DATA FOR REPAIR, ALTERATION AND CHANGE OF USE OF EXISTING BUILDINGS

(Note: *780 CMR 120.S is unique to Massachusetts*)

120.S101.0 - PART ONE-GUIDELINES FOR APPLICATION

120.S101.1 Intent Relative to 780 CMR 34.00 and 93.00. The purpose of 780 CMR 120.S is to provide guidance to users of 780 CMR (the Massachusetts State Building Code) as to techniques of acceptable practice which can be used to assess the acceptability of various methods of meeting the intent of code provisions of 780 CMR 34.00 or 93.00 on a case-by-case basis. The purpose of the provisions in 780 CMR 34.00 and 93.00 and 780 CMR 120.S is to allow the repair, alteration addition, and change of use of existing buildings without requiring the entire building to be brought up to new construction requirements, while still providing for the public health, safety and general welfare. The provisions of 780 CMR 34.00 and 93.00 and 780 CMR 120.S recognize that the provisions of 780 CMR for new construction reflect the latest improvements in materials, construction techniques, standards of living and safety and, therefore, may preclude the repair, alteration, addition, or change of use of existing buildings that have demonstrated their usefulness and safety.

120.S102.0 SCOPE

120.S102.1 Techniques. 780 CMR 120.S is intended to demonstrate techniques of analysis and compliance with 780 CMR 34.00 in the repair, alteration, addition, and change of use of existing buildings.

120.S103.0 GENERAL CONDITIONS

120.S103.1 General Conditions. Conceptually, it is the intent of 780 CMR 34.00 and 93.00 and 780 CMR 120.S to allow repair, alteration, addition, or change of use of existing buildings without meeting all new construction requirements under the following general conditions:

1. all hazardous conditions must be corrected;
2. the existing building becomes the minimum performance standard; and
3. the degree of compliance of the building after changes must not be below that existing before the changes, except that nothing in 780 CMR 34 or 93 will require compliance with requirements more stringent than that required for new construction.

120.S104.0 IMPLEMENTATION

120.S104.1 Framework. Implementation of the above concept requires that a framework be established for evaluating the condition of the building; determining the potential for modification; and establishing the acceptability of proposed changes.

120.S104.2 Evaluation of Existing Building. Evaluation of existing conditions in a structure is required to determine the existence of any hazardous conditions, which must be corrected; and to provide a basis for evaluating the impact of the proposed changes on the performance of the building.

The following list of evaluation tools described in 780 CMR 120.S4.1.1 through 120.S4.2.7 can be used for determining the condition of the structure. However, this list is not necessarily complete and the use of other methods should not be precluded.

120.S104.2.1 Available Documentation of Existing Building. Prime sources of design information for existing buildings are the architectural and engineering drawings and specifications used in the construction of the building. Although the passing of time often obscures depositaries of such documents, the following are likely prospects in attempting to locate such information:

1. If the building is currently in use, an individual or office responsible for its management may have retained drawings and specifications to facilitate maintenance. A building manager, resident engineer, superintendent, custodian, stationary engineer or plant engineer may be the most direct contact at the building site.
2. Other potential sources (especially if the building is not in use) include the original designer-architect or engineer.
3. The building department which issued the permit for construction may have documentation.
4. Documentation may have been retained by the general contractor or numerous sub-contractors; *i.e.*: the mason, carpenter, plumber, electrician, HVAC installer, steel erector, etc., as well as manufacturers of component parts, as potential sources of documentation.
5. In the case of large corporations or government agencies, a separate contracting officer may have developed a technical file on the erection of a building.

6. In some cases, individual consultants are contracted to serve as "clerk-of-the-works" and pursue the inspection of a building project from start to finish with the keeping of a file likely.

7. Insurance companies sometimes maintain drawings or records of their insured buildings.

8. Historical or archaeological societies may have considered a building to be important enough to develop a file of documentation.

120.S104.2.2 Field Surveys. Having drawn upon available documentation to help evaluate a building's condition, such documentation may be augmented by on-site data acquired through field survey. The most obvious approach is to make use of detailed visual examination to confirm and/or alter any previously available information pertaining to the building.

120.S104.2.3 Testing. Testing is a tool that may be used in evaluating the condition of a building or structure or parts thereof when other methods of evaluation will not suffice. Testing may be initiated voluntarily on the part of the permit applicant or may be required by the building official in the absence of approved rules as indicated in 780 CMR 109.0, 116.0, and 780 CMR 34.00 and 93.00 when applicable. The costs of all such tests are to be borne by the permit applicant and should, therefore, be required by the building official only when other methods of evaluation prove inadequate or insufficient. Such testing should be conducted by an approved testing agency under the supervision of a registered architect or engineer. The report of the tests shall be submitted to the building official and shall include the details of test procedures, references to any accepted test standards used, the results of the tests and any conclusions drawn from the test results.

120.S104.2.4 Nondestructive Testing. This includes techniques where the structural integrity of the building is not affected, such as the following:

1. analyzing various portions of the building to determine dimensions, types and condition of materials, etc.;
2. portable apparatus for impact testing;
3. load application short of failure to determine capacity of materials and components;
4. magnetic methods for detecting flaws in ferrous metal;
5. proximity magnetometers (locating rebars in concrete, concealed ferrous fasteners, etc.);
6. electronic means for measuring the sonic modulus of elasticity of concrete and masonry in assessing its soundness;
7. ultrasonic transmission or reflective methods in detecting flaws in various materials; and
8. x-ray or infrared-ray photographic techniques used to evaluate portions of elements whose integrity is questionable.

120.S104.2.6 Destructive Testing. In destructive testing a sample of the building could be removed and tested (*e.g.*, concrete core), or components of the building could be reconstructed and tested in the laboratory.

120.S104.2.7 Laboratory Analysis. In some cases, tests can be performed in the laboratory. Such tests might include the following:

1. chemical or metallurgical test;
2. optical or electronic microscopic examination which can help identify and evaluate the soundness of materials where decay or other molecular degradation is involved;
3. conventional laboratory tests for determining physical properties (strength, ductility, absorption, solubility, permeability, stiffness, *etc.*; and/or
4. testing of a scale model of the building (computer model, wind tunnel model, etc.).

120.S104.3 Evaluation of Change in Performance Level. It is necessary to determine if the level of performance of the building after alteration is below that which existed before the change. The hazard level could be increased for certain attributes (such as fire safety) while decreased for other attributes (such as floor loads) for a given alteration. The evaluation of the change in hazard levels of each attribute can be accomplished using various tools singly or in combination as described below in 780 CMR 120.S4.3.1 through 120.S4.3.5.

120.S104.3.1 Data on Archaic Systems. Performance data on architectural and structural systems encountered are tabulated in 780 CMR 120.S, Part Four. This data can be compared to the proposed altered systems to determine if the performance is adversely affected.

120.S104.3.2 Compliance Alternatives. Alternate solutions tabulated in 780 CMR 120.S, Part Two were developed from appeal data and from accepted practice. The list is not all-inclusive and should not preclude consideration of other alternatives.

120.S104.3.3 Analysis Methods. Analytical methods based on good engineering practice may be used to determine changes in performance levels.

120.S104.3.4 Test Methods. Test procedures as discussed in 780 CMR 120.S4.2.3 through 120.S4.2.6 can be used to evaluate the performance of existing construction.

120.S104.3.5 Professional Judgement. Professional judgement based on previous experience with similar buildings should be used to the fullest extent possible.

120.S201.0 - PART TWO - SUGGESTED COMPLIANCE ALTERNATIVES

120.S201.1 Purpose. The purpose of 780 CMR 120.S201.0 is to assist the building official and those regulated by 780 CMR in judging the acceptability of compliance alternatives to specific provisions required by 780 CMR.

120.S201.1.1 Application. 780 CMR 120.S202.0 contains generally acceptable compliance alternatives and examples. The examples are solely for the purpose of illustrating principles which can be applied to the solution of code compliance problems and are not necessarily acceptable under all circumstances. It is recognized that all building systems interact with each other. Therefore, any consideration of compliance alternatives must take into account all existing and proposed conditions to determine their acceptability. The principles applied can be used for the solution of similar compliance problems in other buildings and occupancy groups. Commentaries are provided where the philosophy in establishing the alternatives is not obvious. The examples were developed from appeal data and accepted practice. They are not all-inclusive and should not preclude consideration of other alternatives.

Note. It is anticipated that additional compliance alternatives will be added to 780 CMR 120.S202.0 through the mechanism of appeal decisions and from results of research being conducted by various organizations in the field of relative permanence of life safety systems.

120.S202.0 – COMPLIANCE ALTERNATIVES FOR EGRESS REQUIREMENTS

(*Note that Compliance Alternatives May be Accepted by the Building Official or not Accepted*)

120.S202.1 Number of Exits.

120.S202.1.1 General Compliance Alternatives:

1. Provide connecting fire balconies.
2. Provide alternate egress facilities.
3. Provide a fire escape.
4. Provide fire-rated areas of refuge.
5. Provide early fire detection.
6. Provide a fire suppression system.

120.S202.1.2 Examples:

Example 1 involves a five-story Building of Use Group B without a fire suppression system and with only one *means of egress*.

Solution A. Add one or more fire escapes as may be necessary to provide all tenants with reasonable access to two *means of egress* in separate directions. Access to a street, public way or area of refuge shall be provided at the termination of the fire escape.

Solution B. Add connecting fire balconies across fire walls if the above solution is impractical due to construction difficulties.

Solution C. Introduce a fire sprinkler system.

Example 2 involves a building of Use Group R-2 occupancy with apartments in the basement. There is only one *means of egress* from the basement.

Solution A. Incorporate emergency escape and rescue systems into each basement apartment that comply with 780 CMR 10.00 of the 6th Edition State Building Code or of 780 CMR 53.00.

Solution B. Introduce a fire sprinkler system.

120.S202.2 Travel Distance.

120.S202.2.1 General Compliance Alternatives:

1. Add detection system.
2. Add a partial fire suppression system.
3. Add smoke doors.
4. Increase fireresistance rating of corridor walls and doors.

120.S202.2.1 Example. This example involves a four story building of Use Group R-2 without a fire suppression system. The length of exitway access travel is 250 feet.

Solution A. Incorporate a fire suppression system for the building.

Solution B. Subdivide corridor into segments, if less than 100 feet, with smoke doors.

Solution C. If the building is pre-existing, non-conforming, install smoke and fire detectors with audible alarms in the corridor.

Solution D. Increase the fireresistance rating of the exit access corridor from one hour to two hours and provide "B" label self-closing or automatic closing fire doors in all openings into the corridor.

120.S202.3 Enclosure of Exitways.

120.S202.3.1 General Compliance Alternatives:

1. Improve enclosure of exitway.
2. Incorporate a fire suppression system.
3. Add early notice fire detection system.

120.S202.3.2 Example. This example involves a four story row building of Use Group R-2 with connecting fire balconies and an interior stair. The stair is enclosed with lath and plaster, wood stud partitions and paneled doors.

Solution A. Cover partitions on the apartment side with ⅝ inch Type X gypsum wallboard or its equivalent. Replace or build up panel doors until minimum solid portion is 1⅜ inch and install self-closers.

Solution B. Provide a heat and smoke detection system in the stairwell with an alarm audible to all tenants. Provide self-closers on all stairwell doors.

Solution C. Provide a fire suppression system for the building. Provide self-closers on all stairwell doors.

120.S202.3.3 Commentary. The above example, while pertaining to a four story, Use Group R-2 building, can also be applied to other buildings of occupancies and floor levels. The principle that the degree of code compliance may not be reduced should be remembered. If the existing enclosure is of fireresistive construction, it must be maintained. The primary principle to remember, in the required enclosure of exitway, is that an enclosure must be provided, whether fireresistive or not, so as to provide a smoke barrier. The purpose of providing a smoke barrier is to prevent the passage of smoke from a fire on one floor to the exitways and exit access corridors of other floors and thus render them unusable for egress. This principle is illustrated by solutions A, B, and C in the above example.

120.S203.0 COMPLIANCE ALTERNATIVES FOR FIRE HAZARDS

120.S203.1 Fire Separations and Partitions.

120.S203.1.1 General Compliance Alternatives:

1. Improve fire separation.
2. Add a fire suppression system.
3. Add a detection system.

120.S203.1.2 Examples. Example 1 involves a three story building of Type 3A construction, containing a Mercantile (M) Use Group, on the first floor and occupancy Business (B) Use on the second and third floors. The required separation is three hours.

Solution A. Add a fire suppression system to the first and second floors.

Solution B. Add 5/8 inch Type X gypsum wallboard or its equivalent to the underside of the second floor and install a system of smoke and heat detectors with audible alarms on the first and second floors.

Example 2 involves the separation between two tenants of wood lath and plaster on a wood studs partition. The required separation is one hour.

Solution A. Add ⅝ inch Type X gypsum wallboard or its equivalent to either side of the existing partition.

Example 3 involves a building of Use Group B with unrated exit access corridors.

Solution A. Install a partial fire suppression system in the exit access corridors.

Solution B. Add ⅝ inch Type X gypsum wallboard or its equivalent to either side of the corridor partition and install self-closers on all corridor doors.

Solution C. Install a smoke and heat detection system in the corridor with and alarm audible to all tenants on the floor and install self-closers on all corridor doors.

120.S203.2 Openings and Exterior Wall Protection:

120.S203.2.1 General Compliance Alternatives:

1. Add fire suppression system.
2. Improve fireresistance.
3. Remove or improve openings.

120.S203.2.2 Examples. Example 1 involves a two story of Type 5B construction building, with Use Group M, on the first floor the basement and upper floors. The distance between the building and the side lot line is five feet and ten feet between it and the adjacent building. The adjacent building is of Type 5B construction and Use Group R-2. The former occupant was a grocery store; the new occupant is a hardware store.

Solution A. Install a deluge sprinkler system along the interior side of the wall affected.

Solution B. Add ⅝ inch Type X gypsum wallboard to interior side of the wall affected.

Example 2 is the same as example 1 but with double-hung wood windows in affected wall.

Solution A. Remove windows and close opening with one hour fireresistive construction.

Solution B. Remove windows and install fire windows.

Solution C. Install a deluge sprinkler system as in solution A to example 1.

120.S301.0 - PART THREE - DETAILED CLASSIFICATION OF OCCUPANCY BY HAZARD INDEX NUMBER AND USE GROUP

120.S303.1 General. 780 CMR 120.S, PART THREE provides a more detailed guide for users of 780 CMR to determine hazard index numbers and use groups for various types of occupancies. 780 CMR 120.S supplements 780 CMR 3.00 and Table 780 CMR 3403.0 contained in 780 CMR 34.00.

Note 1. The Use Classifications and Hazard Indicies shown below now reflect the Use Classifications and Hazard Indicies of the Seventh (7th) Edition State Building Code which, in some instances, utilize a somewhat different Use Classification and Hazard Index classification than that of earlier Editions of the Massachusetts State Building Code.

Note 2. The Use Classifications and Hazard Indicies presented are representative only and property-specific conditions may result in different USE Classifications and resulting Hazard Indicies.

TABLE 120.S1 HAZARD INDEX AND USE GROUP CLASSIFICATION

Use of Structure	Hazard Index No.	Use Group
Advertising Displays Manufacture including billboards	3	F-1
Airport or other aircraft landing or service facility (see also: Helicopter rooftop landing facility	3	F-1
Amusement park, indoor	4	A-3
Animal		
Crematorium	2	B
Hospital, kennel, pound	2	B
Apartment (see Residences)		
Appliances		
Manufacture	3	M
Sales	3	M
Arenas	4	A-3
Asphalt		
Processing and products manufacture	8	H
Athletic equipment		
Manufacture	3	F-1
Sales	3	M
Auditoriums		
with stage	6	A-1
without stage	4	A-3
Automobile and other motor vehicles		
Gasoline service station	2	M
Rental agency within a building	2	B
Repair	3	S-1
Repair incidental to auto sales with limitation	2	B
Sales within a building	3	M
Wrecking	3	F-1B
Washing	2	
Awning manufacturer	3	F-1
Baked goods shop	3	M
Bakeries	3	F-1
Banks	2	B
Banquet halls	5	A-2
Barber shops	2	B
Beauty shops	2	B
Beverages		
Bottling	3	F-1
Manufacture		
Alcoholic (Up to and including 12% alcohol)	3	F-2
Alcoholic (above 12% alcohol)	8	H
Bicycle		
Manufacture	3	F-1
Rental or repair conducted within a building	3	S-1
Sales	3	M or S-1
Billiard Parlor	4	A-3

TABLE 120.S1 HAZARD INDEX AND USE GROUP CLASSIFICATION - continued

Use of Structure	Hazard Index No.	Use Group
Blacksmith shops	3	F-1
Blueprinting, etc. establishments	2 or 3	B or S-1
Boarding house	4	R-1 or R-2
Boats or ships		
Building or repair of boats	3	F-1
Bowling alleys	4	A-3
Broom or brush manufacture	3	F-1
Building materials		
Wholesale business in roofed structures	3	M or S-1 or SPECIAL USE
Bus terminals or stations	4	A-3
Business schools or colleges	2 or other	B or dependent upon use
Camera and other photo equipment		
Manufacture except film sales	3	F-1
Sales	3	M
Canvas or canvas products		
Manufacture or repair	3	F-1
Carpet and rug		
Cleaning establishments	3	F-1
Manufacture or repair	3	F-1
Catering for outside consumption	3	F-1
Cemeteries		
Crematory in cemetery	3	F-1
Mausoleum, crypt, columbarium	1	S-2
Mortuary chapel in cemetery	4	A-3
Ceramics products manufacture, including pottery, small glazed tile and similar items	3	F-2
Charcoal, fuel, briquettes, or lampblack manufacture	8	H
Chemicals		
Packaging	8 or 3	H or F-1 or S-1 depending on nature of material
Manufacture	8 or 3	H or F-1 depending on nature of material
Churches or other places of worship	4	A-3
Circuses, temporary	4	A-3
Cleaning (see Drycleaning & dying; Laundries; Automobiles, washing)	3	F-1
Clothing		
Manufacture	3	F-1
Rental establishment		
Retail sales	2	B
Tailoring, custom manufacture or repair (see also Feathers; Felt; Fur; Leather)	3	F-1
Clubs		
Private	4 or 5	A-2 or A-3
Nightclubs (see Eating & drinking establishments)	5	A-2
Coal, coke or tar products		
Manufacture	8	H
Colleges and Universities		
Classroom buildings	2 or 4	A-3 or B
Dormitories	4	R-2
Fraternities or sororities	2 or 4	R-2 or R-3

TABLE 120.S1 HAZARD INDEX AND USE GROUP CLASSIFICATION - continued

Use of Structure	Hazard Index No.	Use Group
Community centers	4	A-3
Convalescent homes	4	I-1
Convents	2	R-2
Cosmetics or toiletries manufacture	3 or 8	F-1 or H
Cotton ginning	8	H
Cotton wadding or linters manufacture	8	H
Courthouses	2 or 4	B or A-3
Crematoriums		
Animal	2	B
Human	2 or 3	B or F-1
Dance halls	7	A-3
Day care centers	4	E or I-4
Dental offices (see Medical & dental)		
Department stores	3	M
Dormitories	4	R-1 or R-2
Dressmaking shops, custom	3	F-1 or M
Drinking places (see Eating & drinking establishments)		
Drug stores	3	M
Dry cleaning and dying establishments	2 or 4 or 8	B or F-1 or H depending on solvent used
Dwellings (see Residences)		
Eating or drinking establishments	5	A-2
Lunchrooms, restaurants, cafeterias, etc., primarily enclosed	4	A-2
Drive-in	5	A-2
With entertainment or dancing	5	A-2
Electric		
Power or steam generating plants	3 or 8	F-1 or H
Substation	3 or 8	F-1 or H
Electrical appliances, bulbs, wiring, supplies, etc.		
Manufacture	3	F-1
Sales	3	M
Electronic components & supplies		
Manufacture or repair	3	F-1
Feathers		
Curing, dyeing, washing or bulk processing	3 or 8	F-1 or H
Manufacturing exclusive of above	3 or 8	F-1 or H
Felt		
Curing, dyeing, washing or bulk processing	3 or 8	F-1 or H
Products manufacture, exclusive of above	3 or 8	F-1 or H
Fertilizer manufacture	8	H
Film, photographic, manufacture	3 or 8	F-1 or H
Storage and studios	2 or 3 or 8	B or F-1or H
Fire stations	2	B
Fish processing	3	F-1
Food		
Product processing except meat & fish	3	F-1
Retail sales	3	M
Fraternities or sororities	2 or 4	R-1 or R-2 or R-3
Funeral establishments	4	A-3
Fur		
Curing, dyeing, finishing, tanning	3 or 8	H or S-1
Products manufacture exclusive of above	3 or 8	H or S-1
Garage (see Parking garage)		
Garbage incineration or reduction	3 or 8	F-1 or H

TABLE 120.S1 HAZARD INDEX AND USE GROUP CLASSIFICATION - continued

Use of Structure	Hazard Index No.	Use Group
Gas		
Manufacture	3 or 8	F-1 or H
Public utility stations for metering or regulating	3 or 8	F-1 or H
Storage		
2500 cu. ft. or less	3	S-1
more than 2500 cu. ft.	8	H
Gasoline service station (see Automobiles)		
Gelatin manufacture	3	F-1
Generating plants, electric or steam	3 or 8	F-1 or H
Gift shops	3	M
Glass products from previously manufactured	3	S-2
Glue manufacture	3 or 8	F-1 or H
Golf		
Indoor courses or driving ranges	4	A-3
Gymnasiums (without spectator seating)	4	A-3
Grain storage	3 or 8	H or S-1
Hair		
Curing, dyeing, washing, bulk processing	3	F-1
Product manufacture exclusive of above	3	F-1
Hardware	3	F-1
Manufacture	3	M
Retail sales		
Helicopter landing facility, rooftop	3	S-1
Home occupations	2	B
Homes for the aged	4	I-2
Hosiery manufacture	3 or 8	F-1 or H
Hospitals		
Including convalescent, nursing, or rest homes and sanitariums, provided custodial care is not provided for drug addicts, alcoholics, mentally ill or mentally deficient	4	I-2
For care of drug addicts, mentally ill, or mentally deficient	4	I-2
Research or teaching laboratories (see also Animal hospitals)	2 or other	B or other
Hotels	4	R-1
Ice manufacturing (dry or natural)	3	F-1
Ice skating rinks	4	A-3 or A-4
Incineration or reduction of garbage, offal, or dead animals	3	F-1
Industry uses (see specific items)		
Without resulting noise, vibration, special danger, hazard, dust, smoke, fumes, etc.	3 or 8	F-1 or H
Other than above	Based on use.	Based on use.
Ink or inked ribbon manufacture	3	F-1 or H
Jewelry	3	F-1 or M
Kennels (see Animal)		
Laboratories		
Research laboratory not accessory to school or hospital	2 or 8	B or H
Scientific research or teaching laboratory, non-profit, accessory to school, or hospital, subject to limitations	2 or 8	B or H
Laundries		
Hand laundry	2	B
Self service; pick-up and delivery station of laundry or dry cleaner	2	B
Steam laundries without limitations	3	F-1

TABLE 120.S1 HAZARD INDEX AND USE GROUP CLASSIFICATION - continued

Use of Structure	Hazard Index No.	Use Group
Leather		
Curing, dyeing, finishing or tanning	3 or 8	F-1 or H
Product manufacture exclusive of above	3 or 8	F-1 or H
Libraries	4	A-3
Linoleum or oilcloth manufacture	3 or 8	F-1 or H
Liquor sales, package	3	M
Luggage manufacture	3	F-1
Lumber (see Wood)		
Manufacturing	3 or 8	F-1 or H
Matches manufacture	8	H
Mattress manufacture and renovation	3	F-1
Meat Markets	3	M
Slaughtering or packaging	3	F-1
Medical & dental offices	2	B
(see also Laboratories; Orthopedic & medical appliances; Hospitals)		
Meeting hall	4	A-3
Metals, manufacture	3	F-1
Reduction, refining or smelting	8	H
Monasteries	4	R2
Motels	4	R-1
Motor freight stations (see trucking terminals)		
Museums	4	A-3
Musical instruments manufacture	3	F-1
Newspaper publishing	3	F-1
Newsstands	3	M
Novelty products manufacture	3	F-1
Nursing Homes	4	I-2
Offices	2	B
Oilcloth manufacture	3	F-1
Optical equipment or similar precision instruments manufacture	3	F-1
Orphanages	3 or 4	I-1 or I-2
Orthopedic or medical appliance manufacture	3	F-1
Paint, turpentine or varnish		
Manufacture	8	H
Spraying booths	8	H
Paper products manufacture	3	F-1
Parish houses	4	A-3 or R-2
Parking garages	1	S-2
Petroleum or petroleum products		
Refining	8	H
Storage	3	S-1
Pharmaceutical products manufacture	3 or 8	F-1 or H
Photography studio	2	B
Plastics		
Product manufacture	8	H
Raw, manufacture	8	H
Police stations	2	B
Pool rooms	4	A-3
Post offices	2	B
Printing		
Plant	3	F-1
Printing or newspaper publishing	3	F-1
Prisons & other correctional or detention institutions	5	I-3
Pumping station or substation, water or sewage	3 or 8	F-1 or H

TABLE 120.S1 HAZARD INDEX AND USE GROUP CLASSIFICATION - continued

Use of Structure	Hazard Index No.	Use Group
Radio		
Sales	3	M
Studios with audience	4	A-3 or A-4
Studios without audience	4	A-3
Railroad		
Freight terminal	3	S-1
Passenger station	4	A-3
Recreation		
Center, indoor	4	A-3
Community center building	4	A-3
Rectories	4	R-2
Residences		
One-family	2	R-3
Two-family	2	R-3
Apartment	2 or 4	R-2 or R-3
Temporary dwelling structure	4	R-1
Boarding or lodging house	4	R-1 or R-2
Dormitory	4	R-1 or R-2
Fraternity or sorority	2or 4	R-2 or R-3
Hotel, motel apartment with accessory services	4	R-1
Convents, monasteries, rectories	2or 4	R-2 or R-3
Research laboratories (see Laboratories)		
Restaurant, lunch room, cafeteria or other establishments primarily for eating	5	A-2
Retail business	3	M
Stores with combustible or flammable goods constructing a high hazard	8	H
Rubber		
Manufacture (natural or synthetic), including tires, tubes, or similar products	8	H
Products (exclusive or processing) including washers, gloves, footwear bathing caps and the like	3	S-1
Sanatariums		
Not providing custodial care for drug addicts, alcoholics, mentally ill, or mentally deficient	4 or 5	I-1 or R-2
Providing care for the above	4 or 5	I-1 or R-3
Schools (K-12)	4	E
Seminaries	2 or 4	R-2 or R-3
Sewage		
Disposal plant	3 or 8	F-1 or H
Pumping station	3 or 8	F-1 or H
Shoes		
Manufacture	3	F-1
Repair shop	3	F-1
Silverware manufacture, plate or sterling	3	F-1
Skating rinks	4	A-3 or A-4
Soap and detergents		
Manufacturing, including fat rendering	8	H
Packaging	3	F-1
Solvent extracting	8	H
Sporting or athletic goods		
Manufacture	3	F-1
Stores	3	M
Stables	3	S-1

TABLE 120.S1 HAZARD INDEX AND USE GROUP CLASSIFICATION - continued

Use of Structure	**Hazard Index No.**	**Use Group**
Stadiums	4	A-5
Wholesale business, including accessory storage other than flammable liquids, gases and explosives, in roofed structures	1 or 3	S-1 or S-2 or M depending on nature of materials
Stores (see Retail stores; or specific items)		
Tailor shops, custom	2	B
Tanning (see leather; Fur)		
Taxidermist shops	3	M
Telephone exchanges		
Automatic	2	B
Non-automatic	2	B
Television		
Sales	3	M
Studios	3 or 6	A-1 or A-3
Textiles		
Manufacture, including knit & yard goods, thread or cordage, spinning, weaving, dyeing & printing, shoddy manufacture	3	F-1
Theaters	6	A-1
Tires, manufacture	8	H
Tobacco products manufacture including curing	3	F-1
Tools & hardware		
Manufacture	3	F-1
Sales	3	M
Toys		
Manufacture	3	F-1
Trailer park (see Mobile homes)		
Truck		
Repairs	3	S-1
Sales	3	M
Trucking terminals	3	S-1
Turpentine manufacture	8	H
Warehouses	1 or 3 or 8	H or S-1 or S-2 depending on nature of materials
Waterpumping stations	3 or 8	F-1 or H
Wax products manufacture	8	H

120.S401.0 – PART FOUR - ARCHAIC CONSTRUCTION SYSTEMS

120.S401.1 Purpose. The purpose of 780 CMR 120.S401through 120.S402, is to assist the building official and those regulated by780 CMR in evaluating the properties of archaic construction systems.

120.S401.2 Scope. 780 cmr 120.S4 contains data on construction systems no longer in general use but which may be encountered in older existing buildings. It is meant to be used for assessing existing conditions when evaluating how proposed changes will impact upon the performance of the building.

120.S401.3 Application. In any given problem, all available data should be collected and professional judgement exercised in arriving at decisions. Evaluative judgment should be used when test data does not exist or when applying the data contained in this standard.

120.S402.0 ARCHAIC FIRERESISTIVE SYSTEMS

120.S402.1 General. 780 CMR 120.S, Part Four contains a list of fireresistive materials and construction which are not necessarily currently in common use. Some of the hourly ratings contained in the listing predate ASTM E-119 that is in current use. The hourly ratings may be higher or lower if tested according to ASTM E 119. In addition to the data contained herein, see Report BMS92, Building Materials and Structures, dated October 7, 1942, National Bureau of Standards. The data listed below is extracted from the Boston Building Code, *circa* 1943.

120.S402.2 Fireresistive materials and construction.

120.S402.2.1 Minimum Qualities. Materials, to be given the fireresistive ratings specified in this part, shall have the following minimum qualities set forth in 780 CMR 120.S402.2.2 through 120.S402.2.19.

120.S402.2.2 Class 1 Concrete. Concrete of Class 1 shall be so proportioned as to have a strength of at least 1500 pounds per square inch (psi) and the coarse aggregate shall consist of limestone, trap rock, blast furnace slag, cinders containing not more that 20% of combustive material, burned clay or shale.

120.S402.2.3 Class 2 Concrete. Concrete of Class 2 shall be so proportioned as to have a strength of at least 1500 pounds psi, the coarse aggregate consisting of sandstone, granite, quartzite, siliceous gravel or other similar material not over one inch in size.

120.S402.2.4 Masonry. Masonry shall be laid in lime-cement or cement mortar, or approved masonry cement mortar, except that masonry of gypsum tile shall, and masonry of structural clay tile may, be laid in gypsum mortar. Masonry shall be thoroughly bonded by breaking joints in successive courses or by the use of metal ties.

120.S402.2.5 Brick. Brick shall be burned clay or shale, concrete or sand-lime brick of Grade C or better.

120.S402.2.6 Stone. Stone shall be limestone, marble, slate or equally fireresistive natural stone. Sandstone, granite or other stone which, because of its crystalline structure or for other reason, is less fireresistive, shall not be considered fire protection for structural metal, but may be used in a masonry wall not less that 12 inches thick required to have fireresistance. Stone masonry shall have the same fireresistive rating as brick masonry.

120.S402.2.7 Cast Stone. Cast stone masonry shall have the same fireresistive rating as brick masonry.

120.S402.2.8 Concrete Blocks. Concrete blocks, whether solid or hollow, shall have as coarse aggregate limestone, trap rock, blast furnace slag, cinders containing not more than 20% of combustible material, burned clay or shale.

120.S402.2.9 Structural Clay Tile. Structural clay tile shall conform to the specifications for load-bearing tile, floor tile or partition tile. Where partition tile is specified load-bearing tile may be used.

120.S402.2.10 Gypsum. Gypsum tile or pre-cast gypsum concrete, whether solid or hollow, shall conform to Standard Specifications for Gypsum Partition Tile or Block of the American Society for Testing Materials and shall not contain more than 3% by weight of wood or other combustible binder or filler.

120.S402.2.11 Gypsum Concrete. Gypsum concrete shall not contain more than 12½ by weight of wood or other combustive binder or filler and shall have a compressive strength of at least 500 psi. It shall not be used where exposed to the elements.

120.S402.2.12 Lath. Expanded metal or wire lath as a base or reinforcement for plastering shall weigh not less that 2.2 pounds per square yard and shall have not less than 2½ meshes per inch.

120.S402.2.13 Metal Mesh for Masonry. Metal mesh reinforcement specified for masonry fire protection of structural metal shall consist of wire lath strips the full thickness of the masonry, laid in the beds thereof, or its approved equivalent.

120.S402.2.14 Metal Mesh for Concrete. Metal mesh reinforcement specified for concrete fire protection of structural metal shall consist of wire mesh weighing not less than 1½ pounds per square yard with wire spaced not over four inches, or not less than No. 11 gauge steel wire spaced not over four inches apart, or its approved equivalent.

120.S402.2.15 Cement Plaster. Cement plaster shall be proportioned of one part Portland cement, and not more than two parts of sand measured by volume dry and loose to which may be added lime putty or hydrated lime not exceeding 15% of the cement.

120.S402.2.16 Gypsum Plaster. Gypsum plaster, except where otherwise specified, may contain sand, not in excess of three times the weight of the gypsum.

120.S402.2.17 Lime plaster. Lime plaster shall consist of a mixture of one part lime, not over three parts sand, and water.

120.S402.2.18 Pneumatically Projected Mortar. Pneumatically projected mortar made of Portland cement, sand and water shall be rated for fire protection the same as Class 1 concrete.

120.S402.2.19 Concrete Fill. Concrete fill, where specified in 780 CMR 120.S in connection with hollow masonry units shall consist of Class 1 or Class 2 concrete poured in the hollow spaces of the units as they are laid.

120.S402.2.20 Reinforced Concrete. Portland cement concrete or gypsum concrete poured in place as fire protection for beams, trusses and other horizontal or inclined members of structural steel and pneumatically projected mortar applied to structural steel as fire protection shall be reinforced with metal mesh reinforcement. Concrete protection for vertical columns of structural metal shall have reinforcing consisting of No. 5 wire spaced not over eight inches apart or its equivalent. Reinforcement shall be wrapped around the structural member and so arranged as to be completely embedded in the fire protection material and to ensure its integrity.

120.S402.2.21 Reinforced Plaster. Plaster used as fire protection or to resist the spread of fire shall be reinforced with metal lath, except plaster less than one inch thick or masonry or concrete.

120.S402.2.22 Replacement Material. In the protection of structural metal including reinforcement, ½ inch of cement or gypsum plaster may replace an equal thickness of poured concrete or pneumatically projected mortar as protective material; and one inch of cement or gypsum plaster reinforced with metal lath may replace an equal thickness of poured concrete, pneumatically projected mortar or masonry protection.

120.S402.2.23 Plaster. Where plaster is required without other specification, it shall consist of ½ inch of cement or gypsum plaster, except that only gypsum plaster shall be used on gypsum masonry.

120.S402.2.24 Thickness. In 780 CMR 120.S, except where otherwise specifically stated, the thickness given in a list of materials applies to the next following item only, and not to the total thickness where additional materials are specified.

120.S402.2.25 Embedding Limitations. Pipes, wires, conduits and ducts shall not be embedded in or placed behind the fire-protective materials required for the protection of structural steel or iron except as otherwise provided in this paragraph. Above fire-protective hung ceilings and within the enclosed space in buildings of Type 1 construction within which, other than the enclosure, fire protection of steel is not required, pipes, wires, conduits and ducts may be placed, provided they are so arranged and so secured that they will not, either by expanding in the event of fire, or otherwise impair, the effectiveness of the enclosing protective materials. Electric conduits and wires and gas pipes may be embedded in concrete or masonry fire protection of structural steel where the protective material is reinforced with wire mesh, provided they shall have protective covering except over the tops of beams and girders, at least as thick as required for the steel.

120.S5.2.7402.2.26 Damage Protection. In factories, garages, warehouses and other buildings in which the fire-protective covering required for steel or iron columns may be damaged by the movement of vehicles, materials or equipment, such covering shall be protected by metal or other material in a manner satisfactory to the building official.

120.S402.2.27 Firestopping. Firestopping shall mean the stopping off or enclosure at the ends and wherever else specified of the spaced between studs of partitions, joists of floors and roofs and other similar spaces to prevent drafts of air and the communication of fire from one such space to another. Fire-stopping shall consist of wood not less than 1½ inches thick, of sheet metal not less than No. 24 gauge or of masonry, or a combination of such materials. Firestopping shall be tightly fitted in the space to be filled, about pipes, wires and ducts and, if cut or disturbed in the placement of pipes, wires and ducts, shall be repaired.

120.S402.3 Fire Protection of Steel Columns.

120.S402.3.1 Protective Thickness. Structural steel columns required to have fire protection of a given rating shall be covered on all sides with protective material having not less than the thickness necessary for the required rating. Except where "no fill" is specified, re-entrant and other accessible spaces behind the specified outer protection shall be filled with concrete or brick masonry or the material of the outer protection.

120.S402.3.2 Fireresistance Rating. Materials shall be assumed to afford to steel columns fire protection of the rating indicated in the following 780 CMR 120.S402.3.3 through 120.S402.3.6:

120.S402.3.3 Four Hour Rating:

1. Two inches Class 1 concrete.
2. Three inches Class 2 concrete, metal mesh reinforcement.
3. 3½ inches brick masonry.
4. Two layers two inch structural clay partition tile masonry, metal mesh in beds.
5. Two inches structural clay partition tile masonry, concrete fill, metal mesh in beds, ¾ inch gypsum plaster.
6. Four inches structural clay partition tile masonry, concrete fill, metal mesh in beds, _ inch lime plaster.
7. Four inches structural clay partition tile or concrete block masonry, concrete fill, plaster.
8. Three inches hollow gypsum tile masonry and plaster.
9. Two inches gypsum concrete, metal mesh reinforcement.
10. Two inches solid gypsum tile masonry and plaster.
11. Three inches solid cinder concrete block masonry and plaster.
12. Four inches hollow cinder concrete block masonry and plaster

120.S402.3.4 Three Hour Rating:

1. 1¾ inches Class 1 concrete.
2. Two inches Class 2 concrete, metal mesh reinforcement.

3. Two inches gypsum concrete.
4. Two inches solid cinder concrete block masonry and plaster.
5. Two inches structural clay partition tile masonry, concrete fill.
6. Four inches structural clay partition tile masonry, concrete fill, metal mesh in beds, _ inch lime plaster.

120.S402.3.5 Two Hour Rating:

1. 1½ inches Class 1 concrete.
2. Two inches Class 2 concrete, metal mesh reinforcement.
3. One inch Class 1 or Class 2 concrete encased in standard weight steel or wrought iron pipe.
4. Two inches structural clay partition tile masonry and plaster.
5. Two layers plaster, each on metal lath, with ¾ inch air space between, two inches total thickness.
6. Two inches gypsum concrete.
7. Two inches solid or three inches hollow gypsum tile masonry.

120.S402.3.6 One Hour Rating:

1. One inch Class 1 concrete.
2. 1½ inches Class 2 concrete with metal mesh reinforcement.
3. 2¼ inches brick masonry.
4. Two inches structural clay partition tile or concrete block masonry.
5. One inch cement or gypsum plaster on metal lath.

120.S402.3.7 Thickness. The thickness of protection on the outer edges of lugs or brackets need not exceed one inch.

120.S402.4 Fire Protection of Cast Iron Columns.

120.S402.4.1 Protective Thickness. Cast iron columns required to have fire protection of a given rating shall be covered on all sides with protective materials having not less than the thickness necessary for the required rating. Re-entrant spaces, if any on the exterior of cast iron columns, and other accessible spaces behind the specified protection, shall be filled with Class 1 concrete or brick masonry or the material of the outer protection.

120.S402.4.2 Fireresistance Rating. Materials shall be assumed to afford to cast iron columns fire protection of the rating indicating in 780 CMR 120.S402.4.3 through 120.S402.4.5:

120.S402.4.3 Four Hour Rating. Cast iron columns shall not be used where the protection of a four hour rating is required.

120.S402.4.4 Three Hour Rating:

1. Two inches Class 2 concrete.
2. Three inches Class 2 Concrete, metal mesh reinforcement.
3. Two inches structural clay partition tile or concrete block masonry concrete fill.
4. 1½ inches cement or gypsum plaster on metal lath and metal furring to form ½ inch air space.
5. 1½ inches Class 1 concrete.
6. Two inches Class 2 concrete with metal mesh reinforcement.

120.S402.4.5 One Hour Rating:

1. One inch Class 1 concrete.
2. 1½ inches Class 2 concrete with metal mesh reinforcement.
3. One inch cement or gypsum plaster on metal lath.

120.S402.5 Fire Protection of Steel in Reinforced Concrete Columns.

120.S402.5.1 Protection Thickness. The main steel reinforcement, including spiral reinforcement and ties larger than ½ inch, in reinforced concrete columns required to have fire protection of a given rating shall be covered with concrete having not less than the thickness listed in 780 CMR 120.S402.5 for the rating indicating in the following 780 CMR 120.S402.5.2 through 120.S402.5.6.

120.S402.5.2 Four Hour Rating:

1. 1½ inches Class 1 concrete.
2. Two inches Class 2 concrete.

120.S402.5.3 Three Hour Rating. 1½ inches Class 1 or Class 2 concrete.

120.S402.5.4 Two Hour Rating:

1. One inch Class 1 concrete.
2. 1½ inches Class 2 concrete.

120.S402.5.5 One Hour Rating. One inch Class 1 or Class 2 concrete.

120.S402.5.6 Ties less than ½ Inch. The thickness of protection on column ties not larger than ½ inch may be ½ inch may be ½ inch thinner than that listed above.

120.S402.6 Fire protection of Steel Beams, Girders, and Trusses.

120.S402.6.1 Protective Thickness. Steel beams, girders and trusses or the members of trusses, required to have fire protection of a given rating, shall be covered on all sides with material having not less than the thickness necessary for the required rating.

120.S402.6.2 Four Hour Rating:

1. Two inches Class 1 concrete.
2. Three inches Class 2 concrete.
3. Three inches structural clay partition tile or concrete block masonry and plaster.
4. Three inches hollow gypsum tile masonry and plaster.
5. Two inches gypsum concrete.
6. Two inches solid gypsum tile masonry and plaster.

120.S402.6.3 Three Hour Rating:

1 1¾ inches Class 1 concrete.

2. 2½ inches Class 2 concrete.
3. Two inches gypsum concrete.
4. Two inches structural clay partition tile, or concrete block masonry and plaster.
5. Two inches solid, or three inches hollow gypsum tile masonry.

120.S402.6.4 Two Hour Rating:

1. 1½ inches of Class 2 concrete.
2. Two inches gypsum concrete.

120.S402.6.5 One Hour Rating:

1. One inch Class 1 concrete.
2. 1½ inches Class 2 concrete.
3. _ inch or cement or gypsum plaster on metal lath.

120.S402.7 Fire Protection of Steel in Reinforced Concrete Beams.

120.S402.7.1 Protective Thickness. The main steel reinforcement, including stirrups larger than ½ inch, in reinforced concrete beams, girders and trusses, including the ribs of reinforced concrete ribbed floors or roofs where one or both sides of the ribs, in addition to the soffit, are exposed to fire, required to have fire protection of a given rating, shall be covered on all sides with concrete having not less than the thickness listed in 780 CMR 120.S402.7 for the required rating. Where a reinforced concrete floor or roof has a flush ceiling formed with approved permanent masonry filler between ribs, the reinforcement shall have the protection required for reinforcing steel of floors and roofs in 780 CMR 120.S402.8.

120.S402.7.2 Four Hour Rating:

1. 1½ inches Class 1 concrete.
2. Two inches Class 2 concrete.

120.S402.7.3 Three Hour Rating. 1½ inches Class 1 or Class 2 concrete.

120.S402.7.4 Two hour rating:

1. One inch Class 1 concrete.
2. 1½ inches Class 2 concrete.

120.S402.7.5 One Hour Rating. One inch Class 1 or Class 2 concrete.

120.S402.7.6 Stirrups less than ½ Inch. The thickness of protection on stirrups not larger than ½ inch may be less than that listed by not more than ½ inch.

120.S402.8 Fire Protection of Steel Reinforcing in Floors and Roofs.

120.S402.8.1 Protection Thickness. The steel reinforcement in reinforced concrete floors and roofs with flush or plane ceiling, such that the exposure to fire is on the soffit only, required to have fire protection of a given rating, shall be covered with concrete having not less than the thickness listed in 780 CMR 120.S402.8 for the required rating. In floors or roofs having reinforced concrete ribs where the concrete surrounding the steel reinforcement is exposed to fire on one or both sides in addition to the soffit, such reinforcement shall have the protection specified in 780 CMR 120.S402.7 for steel in reinforced concrete beams.

120.S402.8.2 Four Hour Rating:

1. One inch Class 1 concrete.
2. 1¼ inches Class 2 concrete.

120.S402.8.3 Three Hour Rating. One inch Class 1 or Class 2 concrete.

120.S402.8.4 Two Hour Rating:

1. ¾ inch Class 1 concrete.
2. One inch Class 2 concrete.

120.S402.8.5 One Hour Rating. ¾ inch Class 1 or Class 2 concrete.

120.S402.9 Fireresistive Floor and Roof Construction.

120.S402.9.1 Protective Thickness. Floors and roofs required to have resistance of a given rating to the spread of fire shall have such thickness of the materials of which it is constructed, as shall be necessary for the required rating, and structural metal forming a part of such floors or roofs shall have protection against fire of such required rating. Floors and roofs required to have two hour or longer resistance to fire be constructed of noncombustible materials. Granolithic, burned clay tile, ceramic tile or other similar incombustible floor finish of a given thickness may be substituted for an equal thickness, and sand, cinder or other incombustible filling material, with or without embedded wooden screeds, may be substituted for two thirds its thickness, of the floor or roof construction material specified in 780 CMR 120.S402.9, provided that such floors and roofs shall have adequate thickness for structural purposes.

120.S402.9.2 Fireresistance Rating. Floor or roof construction shall be assumed to afford resistance to the spread of fire of the rating indicated in the following 780 CMR 120.S402.9.3 through 120.S4029.6:

120.S402.9.3 Four Hour Rating:

1. Four inches solid slab of reinforced Portland cement concrete or reinforced precast gypsum concrete.
2. Four inches solid masonry arched or slabs.
3. Four inches structural clay floor tile masonry arches or slabs with top covering of not less than two inches of solid masonry or reinforced concrete.
4. Five inches combination reinforced Portland cement concrete slab consisting of permanent fillers of concrete block, gypsum or structural clay tile and 1½ inches of concrete topping; but if structural clay partition tiles are used for fillers, they shall be plastered on the soffit.

120.S402.9.4 Three Hour Rating:

1. Three inches solid slab of reinforced Portland cement concrete or reinforced precast gypsum concrete.
2. Three inches solid masonry arches or slabs.
3. Four inches structural clay floor tile masonry, arches or slabs with top covering of not less than 1½ inches of solid masonry or reinforced concrete.
4. Four inches combination reinforced Portland cement concrete slab consisting of permanent fillers of concrete block, gypsum or structural clay tile and one inch concrete topping; but if structural clay partition tiles are used for fillers, they shall be plastered on the soffit.

120.S402.9.5 Two Hour Rating:

1. 2½ inches solid slab of reinforced Portland cement concrete or reinforced precast gypsum concrete.
2. 2½ inches solid masonry arches or slabs.
3. Three inches structural clay floor tile masonry, arches or slabs with top covering of not less than one inch of solid masonry or reinforced concrete.

120.S402.9.6 One Hour Rating:

1. Three inches structural clay floor tile masonry, arches or slabs with all joints thoroughly filled with cement or gypsum mortar.
2. Wood floor or roof construction with joists not less than one and five eigths inches in least dimension, firestopped, double board floor, approved asbestos felt between lay of boards, and with a ceiling of at least ¾ inch cement or gypsum plaster on metal lath.
3. Steel beams or steel joists not more than 36 inches apart on centers with noncombustible floor and a ceiling of at least ¾ inch cement or gypsum plaster on metal lath furring.

120.S402.10 Fireresistive Ceiling Construction:

120.S402.10.1 Protective Thickness. Ceilings required to afford fire protection of a given rating to the floor or roof framing under which it is supported shall be of fireresistive materials of at least the thickness necessary for the given rating. A fireresistive ceiling and all hangers and fastenings necessary for its support to the protected framing shall be of noncombustible materials. It shall be capable of sustaining its own weight without exceeding allowable stresses. Metal reinforcement in such a ceiling shall be protected from fire as specified in 780 CMR 120.S402.8 for reinforcing in a floor.

120.S402.10.2 Fireresistance Tating. Ceiling construction shall be assumed to afford to floor or roof framing fire protection of the rating indicated in the following 780 CMR 120.S402.10.3 through 120.S402.10.6.

120.S402.10.3 Four Hour Rating:

1. 2½ inches solid slab of reinforced Portland cement concrete or reinforced precast gypsum concrete.
2. Two inches precast reinforced gypsum concrete, plastered.

120.S402.10.4 Three Hour Rating:

1. Two inches solid slab of reinforced Portland cement concrete or reinforced precast gypsum concrete.
2. Two inches precast reinforced gypsum concrete, lapped or rabbeted joints.

120.S402.10.5 Two Hour Rating. 1½ inches solid slab of reinforced Portland cement concrete or reinforced precast gypsum concrete.

120.S402.10.6 One Hour Rating. ¾ inch cement or gypsum plaster on metal lath.

120.S402.11 Fireresistive Bearing Walls and Partitions.

120.S402.11.1 Protective Thickness. Bearing walls and partitions required to have resistance to fire or the spread of fire of a given rating shall be constructed of fireresistive materials and shall have at least the thickness necessary for the required rating. Walls required to have two hour or longer rating shall be of noncombustible materials. Steel reinforcement in reinforced concrete walls shall have the same protection for the given rating as is required in 780 CMR 120.S402.9 for floors.

120.S402.11.2 Fireresistance Rating. Bearing walls and partitions shall be assumed to have resistance to fire and the spread of fire of the rating indicated in the following 780 CMR 120.S402.11.3 through 120.S40211.6:

120.S402.11.3 Four Hour Rating:

1. Eight inches solid brick masonry.
2. 12 inches hollow wall of brick masonry, minimum eight inch masonry thickness.
3. 12 inches structural clay load-bearing tile masonry with two units and not less than three cells in the thickness of the wall.
4. Eight inches structural clay load-bearing tile masonry with one unit and not less than two cells in the thickness of the wall, plastered both sides.
5. 12 inches concrete block masonry with one unit and not less than two cells in the thickness of the wall.
6. Eight inches one piece concrete block masonry with shells and webs at least 1½ inches thick, plastered both sides.
7. 12 inches total thickness of brick masonry facing bonded to structural clay load-bearing tile masonry backing.
8. Eight inches solid concrete.
9. Six inches solid reinforced concrete.
10. A steel or reinforced concrete frame bearing wall in which the steel has fire protection of four hour rating, with panel filling as specified in 780 CMR 120.S402.12 for a nonbearing wall of four hour rating.

120.S402.11.4 Three Hour Rating:

1. Eight inches structural clay load-bearing tile masonry with two units and not less than four cells in the thickness of the wall.
2. 12 inches structural clay load-bearing tile masonry with one unit and not less than three cells in the thickness if the wall.
3. Eight inches one piece concrete block masonry with shells and webs not less than 1½ inches thick, plastered both sides.
4. Eight inches one piece concrete block masonry with shells and webs not less than two inches thick.
5. Five inches solid reinforced concrete.
6. A steel or reinforced concrete frame bearing wall in which the steel has fire protection of three hour rating, with panel filling as specified in 780 CMR 120.S402.12 for a nonbearing wall of three hour rating.

120.S402.11.5 Two Hour Rating:

1. Eight inches structural clay load-bearing tile masonry with not less than three cells in the thickness of the wall.
2. Eight inches concrete block masonry with shells and webs not less than 1½ inches thick.
3. A steel or reinforced concrete frame bearing wall in which the steel has fire protection of two hour rating, with panel filling as specified in 780 CMR 120.S402.12 for a nonbearing wall of two hour rating.

120.S402.11.6 One Hour Rating:

1. A steel or wooden stud bearing wall covered on both sides with one inch cement or gypsum plaster on metal lath, firestopped if of wood.
2. A steel or reinforced concrete frame bearing wall in which the steel has fire protection of one hour rating, with panel filling as specified in 780 CMR 120.S402.12 for a nonbearing wall of one hour rating.

120.S402.12 Fireresistive Nonbearing Walls and Partitions.

120.S402.12.1 Protective Thickness. Nonbearing walls and partitions required to have resistance to fire and the spread of fire of a given rating shall be constructed of fireresistive materials and shall have at least the thickness necessary for the required rating. Walls required to have two hour or longer rating shall be of incombustible materials. Steel reinforcement in reinforced concrete walls shall have the same protection for the given rating as is required in 780 CMR 120.S402.8.

120.S402.12.2 Fireresistance Rating. Nonbearing walls and partitions shall be assumed to have resistance to fire and the spread of fire of the rating indicated in the following 780 CMR 120.S402.12.3 through 120.S402.12.6.

120.S402.12.3 Four Hour Rating:

1. Eight inches solid brick masonry.
2. 3½ inches solid brick masonry, plastered goth sides.
3. Six inches structural clay load-bearing tile, plastered both sides.
4. Six inches solid concrete.
5. Four inches solid reinforced concrete.
6. Any wall which, as a bearing wall, has a three hour or four hour rating in 780 CMR 120.S402.11, except the steel or reinforced concrete frame bearing wall.

120.S402.12.4 Three Hour Rating:

1. 3½ inches solid brick masonry.
2. Four inches structural clay load-bearing tile, plastered both sides.
3. Four inches solid concrete.
4. Three inches reinforced concrete.

5. Any wall which, as a bearing wall, has a two hour rating in 780 CMR 120.S402.11 except the steel or reinforced concrete frame bearing wall.

120.S402.12.5 Two Hour Rating:

1. Three inches gypsum tile masonry plastered both sides except in exterior walls.
2. Eight inches structural clay partition tile masonry, plastered both sides.
3. Eight inches structural clay load-bearing tile, with three cells in the thickness of the wall.
4. 2½ inches solid cement or sanded gypsum plaster on metal lath and noncombustible studding.
5. Three inches total thickness of hollow wall, ¾ inch cement or gypsum plaster on metal lath and noncombustible studding.
6. Three inches total thickness of hollow wall, ¾ inch cement or gypsum plaster on metal lath and wooden studding, firestopped.

120.S402.13 Fireresistive Doors.

120.S402.13.1 General. Doors which are required to be fire doors, fireresistive doors, or of fireresistive construction shall conform to the requirements of 780 CMR 120.S402.13 and 120.S402.14

120.S402.13.2 Classification. Fire doors shall be classified for the proposes of 780 CMR as Class A, Class B, and Class C.

120.S402.13.3 Class A Ffire Doors. Class A fire doors shall be doors of the following construction and as specified in 780 CMR 120.S402.14:

1. Tin-clad, three ply wood core, sliding.
2. Tin-clad, three ply wood core, swinging single leaf, doorway not over six feet wide.
3. Tin-clad, three ply wood core, swinging in pairs, doorway not over feet wide.
4. Hollow metal, swinging single leaf, doorway not over four feet wide.
5. Hollow metal, swinging in pairs, doorway not over eight feet wide.
6. Sheet metal, sliding, single, doorway not over ten feet wide.
7. Sheet metal, sliding in pairs, doorway not over 12 feet wide.
8. Sheet metal, swinging single leaf, doorway not over feet wide.
9. Sheet metal, swinging in pairs, doorway not over ten feet wide.
10. Steel rolling doorway not over 12 feet wide.
11. Steel plate, doorway not over four feet wide.
12. Any other construction equal or superior to a tin-clad three ply wood core door in a standard fire test, for resistance to fire, the spread of fire and smoke, and transmission of heat.

120.S402.13.4 Class B Fire Doors. Class B fire doors shall be doors of the following construction and as specified in 780 CMR 120.S402.14:

1. Tin-clad, three ply wood core.
2. Tin-clad, two ply wood core, sliding, doorway not over ten feet wide.
3. Tin-clad, two ply wood core, swinging single leaf, doorway not over six feet wide.
4. Tin-clad, two ply wood core, swinging in pairs, doorway not over ten feet wide.
5. Hollow metal, sliding, doorway not over eight feet wide.
6. Metal-clad, paneled, swinging single leaf, doorway not over three feet wide.
7. Metal-clad, paneled, swinging in pairs, doorway not over six feet wide.
8. Any other construction equal or superior to a tin-clad two ply wood core door in a standard fire test, for resistance to fire, the spread of fire and smoke, and transmission of heat.

120.S402.13.5 Class C Fire Doors. Class C Fire doors shall be doors of the following construction and as specified in 780 CMR 120.S402.14:

1. Metal-clad, paneled, swinging single leaf, doorway not over four feet wide.
2. Metal-clad, paneled, swinging in pairs, doorway not over eight feet wide.

120.S402.13.6 Substitution. A Class A door may be used where Class b or Class C is specified; a Class B door may be used where Class C is specified. Two Class B or Class C doors on opposite sides of the wall may be used where a single Class A or Class B door is specified.

120.S402.13.7 Overlap. Fireresistive doors, when closed, shall completely cover the doorways in the walls and partitions or the openings in the floors or roofs to which they ar fitted. A swinging fire door shall either overlap both jambs and the head of the opening not less than four inches or be fitted to a fireresistive frame with a rabbet the full thickness of the door and with not less than ½ inch overlap on the door. A sliding fire door, except in enclosures about passenger elevators, shall overlap both jambs and the head of the opening not less than four inches. A sliding fire door in an enclosure about a passenger elevator shall overlap jambs, head and adjoining panels not less than ½ inch. Fire doors shall fit closely at the floor with clearance of not over ¼ inch.

120.S402.13.8 Thresholds. In buildings with combustible floors, doorways required to have fire doors shall have noncombustible thresholds the full thickness of the wall, extending at least four inches from the face of the wall where a door is hung and extending laterally at least six inches behind each jamb of the doorway. Thresholds may be flush with the floor.

120.S402.13.9 Rabbeted Frame. The rabbeted frame of a swinging fire door shall be constructed of structural steel built into the concrete, masonry or other fireresistive material of the wall about the opening and secured thereto, except that the rabbeted frame of a Class B or C door may be of wood, covered with sheet metal not less than No. 26 gauge in thickness, secured to the wall in the opening.

120.S402.13.10 Fit. Fire doors when closed shall fit tightly against the wall or frame so as to provide an effective stop for fire and smoke. Except for the metal-covered wooden frame specified in 780 CMR 120.S402.10, combustible material shall not intervene between the door and the fireresistive material of the wall, floor or roof to which it is fitted.

120.S402.13.11 Hardware. Hinge hardware for fire doors shall be of malleable iron or rolled structural steel not less than ¼ inch thick except that tubular steel track for sliding doors may be not less than _ inch thick. Equivalent thickness of solid bronze or brass may be used. Fire doors shall not depend upon cords, cables or chains to support them in closed position except in elevator shafts.

120.S402.13.12 Tracks. Tracks for sliding fire doors shall be so supported that a track hanger comes at each door hanger when the door is closed. Track hangers shall be secured to wood stud walls by through bolts and to concrete walls by through bolts or approved built-in inserts. Expansion shields shall not be used to support fire doors.

120.S402.13.13 Hinges. Hinges for swinging fire doors, except in wooden stud walls, shall be riveted or through-bolted to the structural steel frame of the opening, through-bolted to the wall if of masonry or concrete or secured by approved inserts in the concrete or built into masonry in an approved manner

120.S402.13.14 Strap Hinges. Strap hinges and sliding door hangers shall be secured to fire doors by through-bolting, riveting or welding. Swinging fire doors in rabbeted frames, except tin-clad, wood core doors, may be hung on butts. Other swinging fire doors shall have strap hinges.

120.S402.13.15 Straps, Locks and Latches. Sliding fire doors shall have adequate stops for the closed position. Swinging Class A fire doors shall have surface lathes or unit locks. Class B and C doors shall have surface latches, unit or mortise locks. The latch bolts of unit or mortise locks on fire doors shall have a throw of ¾ inch. When mounted in pairs, fire doors shall be rabbeted by means of an astragal or otherwise where they come together. One of a pair of swinging fire doors shall have push bolts at top and bottom with a throw of ¾ inch and the other shall be held by latch to the first.

120.S402.13.16 Opening Hardware. Except in detention buildings, fire doors hung in required exits shall be so fitted with hardware that they can be opened from inside without use of a key when the building is occupied.

120.S402.14 Fire Door Construction

120.S402.14.1 Fastening. In the construction of fire doors, solder shall not be used except for filling joints. Sheet metal shall be fastened to wood by nailing and to metal frame by bolting, riveting or welding.

120.S402.14.2 Glass. Class A doors shall not have glass panels. Class B doors may have glass panels not larger than 100 square inches in exposed area nor more than 12 inches in width or height. Class C doors may have glass panels not larger than 2,016 square inches in total exposed area, and any single light shall not have an exposed area exceeding 1,296 square inches. Glass in fire doors shall be wire glass not less than on quarter inch thick and shall be set ⅝ inch in grooves three quarters of an inch deep.

120.S402.14.3. Deleted

120.S402.14.4 Tin-clay, Two Ply. In-clad, two ply wood core doors shall be shall be constructed in accordance with the specifications of the National Board of Fire Underwriters for such doors in Class B openings and shall bear the label of the Underwriters' Laboratories to this effect.

120.S402.14.5 Hollow Metals. Hollow metal doors shall have substantial stiles and rails of heavy pressed steel, reinforced for hinges and other hardware. Panels shall be of sheet filled with asbestos board or other approved insulating materials. The door shall be assembled by welding or riveting.

120.S402.14.6 Sheet Metals. Sheet metal doors shall be constructed with a rolled steel rigid frame covered both sides with $^{1}/_{16}$ inch asbestos board and No. 26 gauge corrugated steel metal, with corrugations vertical on one side and horizontal on the other, bound on the edges with rolled steel or pressed steel shapes.

120.S402.14.7 Steel Rolling. A steel rolling fire door shall be constructed of sheet steel interlocking slats, sliding in grooves, counterweighted by springs, with the roller and mechanism enclosed in heavy sheet metal.

120.S402.14.8 Steel Plate. A steel plate fire door shall be constructed of not less than No. 12 gauge steel plate mounted on a rolled steel frame, assembled by welding or riveting.

120.S402.14.9 Metal Clad. A metal clad, paneled fire door shall have a wood core with stiles and rails not less than 1¾ inches thick covered with No. 26 gauge sheet steel; panels ¾ inch thick covered with No. 26 gauge sheet steel, set ¾ inch in grooves; joints of metal lapped and well nailed.

120.S402.14.10 Class A Label. A door properly bearing the Underwriters' label certifying that it is suitable for the protection of a Class A opening shall be acceptable as a Class A door.

120.S402.14.11 Class B Label. A door properly bearing the Underwriters' label certifying that it is suitable for the protection of a Class B opening shall be acceptable as a Class B door, except that metal clad doors wider than three feet shall not be accepted as Class B doors.

120.S402.14.12 Class C Label. A door properly bearing the Underwriters' label certifying that it is suitable for the protection of a Class C opening shall be acceptable as a Class C door.

120.S402.15 Fireresistive Shutters. Shutters required to be fire shutters or fireresistive shutters shall be constructed and hung as specified for Class B fireresistive doors in 780 CMR 120.S402.13 and 120.S402.14.

120.S402.16 Fireresistive Windows.

120.S402.16.1 General. Windows which are required to be fire windows, fireresistive windows, or of fireresistive construction shall conform to the requirements of 780 CMR 120.S402.16.

120.S402.16.2 Moveable. Firereisistive windows may be fixed or arranged to open and close. Fixed fireresistive windows shall be so secured in the walls in which they are placed that they may expand in case of fire without buckling. Moveable firereisitive windows shall be opened or closed in one of the following manners:

1. One or more sashes may slide horizontally in a fireresistive frame.
2. One or more sashes may slide vertically with counterweights or with tow sashes counterbalanced and hung on chains. If a sash is closed in raised position, it shall have a fastening.
3. A sash may be hinged at top, bottom, or either side.
4. A sash may be pivoted at top and bottom or at the sides.
5. A sash may be arranged to open and close in any other approved manner, with approved hardware.

120.S402.16.3 Sash. Moveable sashes in fireresistive windows shall be furred to fireresistive frames of the same or similar construction. Both sashes and frames, and metal mullions between window units, shall be so fitted in the walls in which they are placed as to be continuous with the fireresistive material of the wall and so secured that they may expand in case of fire without buckling.

120.S402.16.4 Glass. Glass in firereisistive windows shall be wired glass not less than one quarter inch thick and the area of a single light shall not exceed 720 square inches. Glass shall be set in three eigths inch grooves at least one half inch deep. Glass shall be secured by glazing angles or molding screwed to the sash and forming continuous grooves for the glass.

120.S402.16.5 Construction. Fireresistive windows shall be of the following construction:

1. Hollow sheet metal sashes and frames fabricated by pressing, welding, riveting or crimping without the use of solder or other fusible alloy, except for filling joints, and bearing the label of Underwriters' Laboratories.
2. Rolled steel or pressed steel sashes fabricated by pressing, welding, riveting or crimping, of a make and style approved by the commissioner.
3. Any other approved constructions as fireresistive as that specified in 780 CMR 120.S402.16.5 item.

120.S402.16.6 Hollow Sheet Metal. Fired fireresistive windows of hollow sheet metal construction shall not exceed seven feet in width not ten feet in height. Fireresistive windows of hollow sheet metal construction with moveable sashes shall not exceed six feet in width nor ten feet in height.

120.S402.16.7 Rolled Steel. Fireresistive windows of rolled steel construction shall not exceed 84 square feet in area not 12 feet in either height or width.

120.S402.16.8 Wind Pressure. Fireresistive windows and their fastenings shall be capable of resisting the wind pressure on the wall of the building applied either on the inside or the outside of the window exceeding allowable stresses.

120.S402.16.9 Substitution. Where fireresistive windows are required, wooden windows and plain glass may be substituted provided the openings are protection by fireresistive doors or shutters, or, in buildings of approved occupancy and construction, by an approved system of open sprinklers.

120.S402.17 Fireresistive Roof Covering.

120.S402.17.1 Classification. Roof covering allowed under this code shall be classified as fire-retardant or ordinary, according to resistance to fire outside, as provided in 780 CMR 120.S402.17. Fire-retardant roof covering is the more firereisistive and may be used where fire-retardant roofing is specified. Roof covering less fireresistive than ordinary roof covering shall not be used on any building.

120.S402.17.2 Fire-retardant Roofing. Fire-retardant roofing shall be any roof covering than meets the requirements of Class A or Class B roofing under the specifications of the Underwriters' Laboratories, Inc. The following roof covering shall be assumed to meet the requirements for fire-retardant roofing:

1. Built-up roofing consisting of successive layers of roofing felt impregnated with asphalt; a final layer of asphalt in which, while molten, is embedded a continuous layer of roofing gravel or slag.
2. Built-up roofing consisting of successive layers of roofing felt impregnated with coal tar; a final layer of tar in which, while molten, is embedded a continuous layer of roofing gravel or slag.
3. Built-up roofing consisting of successive layers of roofing felt impregnated with asphalt; a final layer of asbestos roofing felt impregnated with asphalt weighing not less than 14 pounds per 100 square feet, or a final layer of asphalt-saturated prepared roofing coated with granulated slate or other similar material.
4. Built-up roofing consisting of successive layers of roofing felt impregnated with tar or asphalt and a finish of burned clay floor tile, stone flagging, cement concrete or other similar material.
5. Sheet metal with locked and soldered joints not less than No. 26 gauge in thickness.
6. Shingles of natural slate.
7. Shingles of burned clay tile.
8. Shingles of sheet metal not less than No. 26 gauge in thickness.
9. Shingles of asbestos board not less than ⅛ inch thick.
10. Shingles of asphalt saturated felt surfaced with granulated slate or other similar material and carrying the Underwriters Class "C" label.
11. Corrugated sheet metal with lapped joints not less than No. 26 gauge in thickness.
12. Corrugated asbestos board not less than 3/16 inch thick.

120.S402.17.3 Ordinary Roofing. Ordinary roofing shall be of any roof covering which meets the requirements of Class C roofing under the specifications of the Underwriters' Laboratories, Inc. The following roof covering shall be assumed to meet the requirements for ordinary roofing:

1. Built-up roofing consisting of successive layers of roofing felt impregnated with asphalt, coal tar or other approved material, not equal in fireresistance to a fire-retardant roofing.
2. Prepared roofing consisting of felt or fabric impregnated or coated, or both, with asphalt, tar or other approved material or shingles of such prepared roofing, not equal in fireresistance to fire-retardant roofing.
3. Canvas stretched tightly and coated with paint.

120.S402.17.4 Means of Securing. Built up roofing shall be secured to the roof deck in the following manner:

1. Over masonry slab, the first layer shall be laid in molted asphalt or tar mopped on the roof deck, after the deck is properly primed, or by nailing a layer of building paper to nailing inserts other than wood placed in the deck.
2. Over wood decks, the built-up roofing shall be secured by nailing a layer of building paper to the roof deck over which the prepared roofing is to be laid with the first layer laid in molten asphalt or tar.
3. Roofings other than built-up roofings, such as shingles, slates, and tile roll roofing shall be well secured to the deck by nailing, bolting, wiring, or other approved methods.

NON-TEXT PAGE

780 CMR 120.T (RESERVED)

(PAGES 1091 THROUGH 1094 ARE RESERVED FOR FUTURE USE.)

780 CMR 120.U

INDEPENDENT STRUCTURAL ENGINEER REVIEW

(See 780 CMR 110.11 of the *Sixth Edition of the Massachusetts State Building Code*)

120.U101 Primary Structure: For the purposes of the independent structural engineering review, the primary structure shall be defined as the structural frame, the load supporting parts of floors, roofs, and walls, and the foundations. Cladding, cladding framing, stairs, equipment supports, ceiling supports, non-load bearing partitions, and railings are excluded from this definition of primary structure.

120.U102 Reviewing Engineer: The reviewing engineer shall be engaged by the owner.

120.U102.1 Qualifications: The reviewing engineer shall be a registered professional engineer, registered in Massachusetts, qualified by experience and training and who shall have had structural design experience with buildings or structures similar to that covered by the application for the building permit. The reviewing engineer shall be impartial, and shall be independent of the architect of record, structural engineer of record, and contractors and suppliers who will be involved in the construction of the structure.

120.U103 Criteria for Review: The reviewing engineer shall review the plans and specifications submitted with the application for the building permit for compliance with the structural and foundation design provisions of the Code. The reviewing engineer shall perform the following tasks:

1. Check to assure that the design loads conform with 780 CMR;
2. Check that other design criteria, and design assumptions, conform to 780 CMR and are in accordance with accepted engineering practice;
3. Review geotechnical and other engineering investigations that are related to the structural design to determine if the design properly incorporates the results and recommendations of the investigations;
4. Check that the organization of the structure is conceptually correct ; and
5. Make independent calculations for a represent-ative fraction of systems, members, and details to check their adequacy. The number of representative systems, members, and details shall be sufficient to form a basis for the reviewer's conclusions.

120.U103.1 Structural Calculations: The structural calculations prepared by the structural engineer of record shall be submitted to the reviewing engineer, upon the reviewing engineer's request, for his or her reference only. The reviewing engineer shall not be obligated to review or check these calculations. If the design criteria and design assumptions are not shown on the drawings or in the computations, the structural engineer of record shall provide a statement of these criteria and assumptions for the review.

120.U104 Structural Engineer of Record: The structural engineer of record shall retain sole responsibility for the structural design, and the activities and reports of the reviewing engineer shall not relieve the structural engineer of record of this responsibility.

120.U105 Report and follow-up:

1. The reviewing engineer shall prepare a report to the building official stating whether or not the structural design shown on the drawings and the specifications conform with the structural and foundation requirements of 780 CMR. Said report shall be based on the review as prescribed in 780 CMR 120.U and shall include a summary of all deficiencies, if any, which cannot be resolved with the structural engineer of record.
2. The structural engineer of record shall review the report of the reviewing engineer, and notify the building official in writing, whether or not he agrees with or disputes the conclusions and recommendations of the reviewing engineer.
3. Unresolved disputes between the structural engineer of record and the reviewing engineer shall be submitted by the building official, the owner, the structural engineer of record or the reviewing engineer to the Structural Peer Review Advisory Board for resolution.
4. Any changes to the structural design subsequent to the original submission of the plans and specifications shall be shown on revised drawings and specifications, submitted with an amendment to the application for permit. The reviewing engineer shall review the changes on the revised drawings and specifications, and, if the original report does not account for the changes in said drawings and specifications, a supplementary report relating to the changes and prepared by the reviewing engineer shall be made to the building official.

120.U106 Foundation Permits: When the plans and specifications are partially complete and an application is made for a foundation permit, the reviewing engineer may review the foundation plans and specifications on a conditional basis, provided that the reviewing engineer is given sufficient documentation so that he can perform 780 CMR 120.U103, Tasks 1, 2, 3, and 4 for the whole structure, and so that he can perform 780 CMR 120.U103, Task 5 for that part of the foundation covered by the application for foundation permit. The reviewing engineer shall prepare a report on that part of the foundation covered by the application for foundation permit, as prescribed in 780 CMR 120.U105, stating all conditions upon which the report is based. When the reviewing engineer reviews the completed plans and specifications as prescribed in 780 CMR 120.U103, the reviewing engineer shall reperform Tasks 1, 2, 3, and 4, as necessary, to include all the revisions to the design subsequent to the application for the foundation permit.

780 CMR 120.V

ENERGY PROVISIONS

- For new construction one- and two-family dwellings and other low-rise residential buildings*, except hotels and motels, *see* 780 CMR 61.00.
- For existing one- and two-family dwellings and other low rise residential buildings, except hotels and motels, *see* 780 CMR 93.00.
- For new construction buildings other than low rise residential building, *see* 780 CMR 13.00
- For existing buildings, other than low-rise residential buildings, *see* 780 CMR 34.00.

* Low rise residential buildings are any residential use up to three stories in height, except hotels and motels.

NON-TEXT PAGE

780 CMR 120.W

FLOOR PROTECTOR THERMAL CONDUCTIVITY CALCULATIONS

(Reference 780 CMR 60.00, as applicable, for solid fuel-burning appliances)

OVERVIEW

Floor protection requirements for heat producing appliances are typically included as part of the tested/listed installation criteria for such appliances.

Such floor protection, listed as a thermal conductivity factor is often developed utilizing NFPA SUBJECT 1618, *Outline of Investigation for Wall Protectors, Floor Protectors, and Hearth Extensions*. (Note that an NFPA SUBJECT is not treated nor maintained in the same manner as an NFPA standard).

When floor protection is developed utilizing NFPA SUBJECT 1618, or developed via "good Engineer-ing Practice", such methodology will typically estab-lish floor protection based on ⅜ inch millboard.

As the thermal conductivity of such millboard can vary from manufacturer to manufacturer, it will be necessary to obtain the thermal conductivity value from a specific manufacturer for a specific millboard product.

Typical thermal conductivity values can range from:

$$k = 0.21 \text{ (Btu) (inch) / (foot}^2\text{) (hour) (°F)}$$

to

$$k = 0.84 \text{ (Btu) (inch) / (foot}^2\text{) (hour) (°F)}$$

Thus the necessity for product specific thermal conductivity.

Note that the lower the algebraic value of "k", the lower the thermal conductivity and the less heat per given time that is transferred across the *floor protector*.

Note that in the following discussions it is necessary to maintain consistent dimensions - i.e.; in dealing with the thickness of materials, do not mix feet with inches, but rather keep all dimensions in inches.

COMPLIANCE

If the manufacturer of the appliance specifies an acceptable material and thickness for floor protection it is necessary, utilizing that specific material with specific thermal conductivity, k, to meet or exceed the thickness specified in order to assure compliance with the listed floor protection requirements of the appliance.

ESTABLISHING EQUIVALENCY

If it is determined that another material of different thermal conductivity is desired to be utilized for floor protection (i.e., perhaps for aesthetic reasons or in order to minimize the thickness of the floor protector) and noting that the thermal conductivity, k, is linear as a function of thickness (for a given single material) then:

$$k_1/t_1 = k_2/t_2,$$

where:

k = thermal conductivity in

(Btu) (inch) / (foot^2) (hour) (°F) and

t = thickness in inches

and therefore knowing any three of the variables of k and t allows one to solve for the remaining variable; i.e., :

Knowing k_1, t_1 and t_2, one can solve for k_2:

$$k_2 = (k_1)\,(t_2)/(t_1)$$

Knowing k_1, t_1 and k_2, one can solve for t_2:

$$t_2 = (k_2)\,(t_1)/(k_1)$$

COMPOSITE FLOOR PROTECTOR ASSEMBLIES

When an assembly consists of more than one material, the assembly is defined as a composite "material".

When a floor protector is constructed of more than one material; i.e., some form of backer board with decorative tile over, it is helpful to first establish the thermal resistance, r, of each material as thermal resistances may be directly added together and then convert the resulting total R to an equivalent thermal conductivity.

r = (foot^2) (hour) (°F)/(Btu) (inch) and;

$$R = (r)\ (t)$$

where r is for a particular material in the composite and t is the thickness of that particular material.

Thus for the two-material example of backer board plus decorative tile,

$$R_{\text{total}} = R_{\text{backer Board}} + R_{\text{decorative tile}}$$

and;

$$R_{\text{backer board}} = (r_{\text{backer board}})\,(t_{\text{backer board}})$$

and;

$$R_{\text{tile}} = (r_{\text{tile}})\,(t_{\text{tile}})$$

RELATIONSHIP BETWEEN *k* AND *R*

By definition:

$R = (1/k)\,(t)$ for each distinct material.

NON-TEXT PAGE

780 CMR 120.X

SCHEDULE OF FEES

120.X101 Fee Schedule: In accordance with the authority conferred by M.G.L. c 143, § 94, the State Board of Building Regulations and Standards hereby establishes the following fees as specified in 780 CMR Table 120.X101.

Exceptions:

1. Fees for projects which are under the jurisdiction of a city or town shall be as duly established by said city or town in accordance with 780 CMR 5114.
2. Fees for construction related licenses issued by a city or town shall be in accordance with fee schedules established by said city or town.
3. Fees for administrative appeals hearings in cities of towns having duly established building code appeals boards in accordance with 780 CMR 5122 shall be as established by said city or town.

780 CMR TABLE 120.X101

Fee Item	Period of Certification or Licensure	Fee (Dollars)	780 or M.G.L. Authority or Reference
Concrete Testing Laboratory			**780 CMR 110.R1[a]**
Initial license	One year	150.00	780 CMR 110.R1.1.8
Renewal	One year	150.00	780 CMR 110.R1.1.10
Concrete Test Technician - Class A			780 CMR 110.R2[a]
Initial license	One year	50.00	780 CMR 110.R2.1.9
Renewal	One year	50.00	780 CMR 110.R2.1.11
Initial license & Renewal Fees for employees of: municipalities, counties, Federal Government, Commonwealth of Massachusetts or any department, commission, agency or authority of, or created by the Commonwealth	One year	No Fee	780 CMR 110.R2.1.9
Examination	Per exam	Note 1	780 CMR 110.R2.1.7
Manufactured Buildings			780 CMR 110.R3[a]
Manufacturer - initial certification (per system)	One year	1200.00	780 CMR 110.R3.18.1
Manufacturer -renewal of certification	One year	650.00	780 CMR 110.R3.18.3
Certificates\Labels per unit	Per label	50.00	780 CMR 110.R3.18.4
Replacement certificate\label	Per label	2.00	780 CMR 110.R3.18.4
Certificates\Labels per component	Per label	2.00	780 CMR 110.R3.18.4
Inspection Agency - initial certification	One year	500.00	780 CMR 110.R3.18.2
Inspection Agency - certification renewal	One year	500.00	780 CMR 110.R3.18.3
Registration of Producers of Native Lumber			780 CMR 110.R4[a]
Initial registration fee	Two years	50.00	780 CMR 110.R4.1.4
Registration renewal	Two years	25.00	780 CMR 110.R4.1.5
Construction Supervisor License (CSL)			780 CMR 110.R5[a]
Unrestricted license (any building enclosing up to 35,000 cubic feet of space)			
Initial license	Three years	150.00	780 CMR 110.R5.2.5
Renewal	Two years	100.00	780 CMR 110.R5.2.5
Examination fee	Per exam	Note 1	780 CMR 110.R5.2.5
Restricted License (one and two family dwellings)			
Initial license	Three years	150.00	780 CMR 110.R5.2.5
Renewal	Two years	100.00	780 CMR 110.R5.2.5
Examination fee	Per exam	Note 1	780 CMR 110.R5.2.5
Restricted License - Masonry only			
Initial license	Three years	150.00	780 CMR 110.R5.2.5
Renewal	Two years	100.00	780 CMR 110.R5.2.5
Examination fee	Per exam	25.00	780 CMR 110.R5.2.5

780 CMR TABLE 120.X101 - continued

Fee Item	Period of Certification or Licensure	Fee (Dollars)	780 or M.G.L. Authority or Reference
Home Improvement Contractor Registration			M.G.L. c 142A & 780 CMR 110.R6[a]
Initial Certification (applicants holding CSL License)	Two years	No fee	
Initial Application (all other applicants)	Two years	100.00	
Renewal (applicants holding CSL License)	Two years	No fee	
Renewal (all other applicants)	Two years	100.00	
Guaranty Fund Payment (upon initial registration - all applicants)			
0-3 employees	Note 2	100.00	
4-10 employees	Note 2	200.00	
11-30 employees	Note 2	300.00	
over 30 employees	Note 2	500.00	
Certification of Building Commissioners, Inspectors of Buildings and Local Inspectors.			M.G.L. c 143, § 3 & 780 CMR 110.R7[a]
Certification fee		no fee	
Examination registration		Note 1	
Continuing education programs provided directly by the Board of Building Regulations and Standards		Reserved	
State Building Code Appeal Board			M.G.L. c 143, § 100
Administrative Hearing	Per hearing	150	780 CMR 122.3.1
Structural Peer Review Advisory Board			
Mediation Hearing		No fee	Not applicable to one- and two family dwellings
Building Permits and Construction Inspection for State Projects (except Massachusetts Bay Transportation Authority Projects) subject to 780 CMR and under the jurisdiction of the Department of Public Safety, Division of Inspections.			M.G.L. c 143, §§ 93 & 94 M.G.L. c 143 § 3A
Plans examination, construction inspection, issuance of building permit and certificate of and occupancy Note: This fee structure shall be deemed to include, but not be limited to, electrical, plumbing mechanical and fire protection work. Fees shall not be permitted to be levied by local jurisdictions.	Per building or structure.	0.005 times the contract amount - minimum fee for a single project shall be $25.00 (Note 3)	M.G.L. c 143, §§ 93 & 94
Massachusetts Bay Transportation Authority Projects			M.G.L. c 161A, § 18
Massachusetts Bay Transportation Authority Projects subject to 780 CMR.		No fee	M.G.L. c 161A, § 18
Periodic Inspections of Existing Buildings under the jurisdiction of the Division of Inspections, Department of Public Safety			780 CMR 106.5 & M.G.L. c 111
Hospitals and Clinics (certificate of inspection)			
First 100 beds	Two years	50.00	M.G.L. c 111, § 51
Each additional 25 beds	Two years	10.00	
Infirmaries; Convalescent Homes; Nursing Homes; Charitable Homes for the Aged; Rest Homes; Intermediate Care Facilities for the Mentally Retarded. (certificate of inspection)	Two years	50.00	M.G.L. c 111, § 71

780 CMR TABLE 120.X101 - continued

Fee Item	Period of Certification or Licensure	Fee (Dollars)	780 or M.G.L. Authority or Reference
Periodic Inspections of all other existing buildings.			M.G.L. c 143, § 94
Periodic inspections of specified use groups as specified by the *Sixth Edition of the Massachusetts State Building Code.*	As specified by 780 CMR	As specified by 780 CMR	
Certification of Building Commissioners, Inspectors of Buildings, and Local Inspectors			M.G.L. c.143, §§ 94 & 99 & 780 CMR 110.R7[a]
Certification Preparation Course of Instruction		zero – 500.00 See Note 4	M.G.L. c.143, §§ 94 & 99 & 780 CMR 110.R7 & the General Appropriation Act
Building Code Training			
One to Two Hour Session	. . . .	zero - 25.00 See Note 4	"
½ Day Training Session	. . . .	zero - 50.00 See Note 4	"
1 day Training Session	. . . .	zero - 100.00 See Note 4	"
Multi Session Training	. . . .	zero - 1000.00 See Note 4	"

a. Per the *Sixth Edition of the Massachusetts State Building Code*

Notes:

1. Examination fees established by examining institution.
2. M.G.L. c 142 A. § 11 provides that additional payments into the guaranty fund may be required if the fund administrator determines that the amount of the fund is insufficient to maintain it at a level commensurate with claims made against said fund.
3. Contract amount, for the basis calculation of permit fees, shall include the entire scope of work of the project and shall include all incidental constructions. Contract amount, for the basis of calculation of permit fees, shall not be deemed to include design fees or any other professional fees associated with construction observation or supervision or construction management.
4. Fees for continuing education of building officials and building code training will be established by the agency and may vary due to costs associated with each individual training session. Cost of materials, space rental, and contracted instructors, may influence fees.

NON-TEXT PAGE

780 CMR 120.Y

HISTORIC STRUCTURES

Historic structures eligible for individual listing in the National Register of Historic Places, qualifying as totally preserved buildings (see 780 CMR 9309.0).

Acton	Faulkner Homestead, High Street
Agawam	Capt. Charles Leonard House, Main Street
Amherst	Emily Dickinson Museum, 280 Main Street
Amesbury	Rocky Hill Meetinghouse, Portsmouth Road
Arlington	Fowle-Reed-Wyman House, 64 Old Mystic Street Jason Russell, 7 Jason Street Old Schwamb Mill, 17 Mill Lane
Barre	Barre Historical Society, Common Street
Barnstable	Barnstable Custom House, Route 6A
Bedford	Job Lane House, 295 North Road
Beverly	John Balch House, 448 Cabot Street Capt. John Cabot House, 117 Cabot Street Rev. John Hale House, 39 Hale Street
Boston	Gleason House, Beacon Street James Blake House, E. Cottage Street (Dor.) Clapp Houses, 105 Boston Street (Dor.) Loring-Greenough House, 12 South Street (JP) Old State House, 15 State Street Pierce House, 24 Oakten Avenue (Dor.) South End Historical Soc., 532 Mass. Avenue Isabella Stewart Gardner Museum, 280 The Fenway Nichols House, 55 Mt. Vernon Street
Boxford	Holyoke-French House, Elm Street Sylvanius-Thayer Birthplace, 786 Washington St
Brookline	Edward Devotion House, 347 Harvard Street
Burlington	Francis Wyman House, Francis Wyman Road
Cambridge	Cooper-Frost-Austin House, 21 Linnaean St.
Charlton	Ryder Tavern, Stafford Street
Chelmsford	Old Chelmsford Garrison House, 105 Garrison Road
Chelsea	Gov. Bellingham-Cary House, 34 Parker Street
Cohasset	Caleb Lothrop House, 14 Summer Street
Cummington	William Cullen Bryant Homestead, Bryant Road
Danvers	Fowler House, 166 High Street Rebecca Nurse House Glen Magna House
Dennis	Josiah Dennis Manse, Nobscuset Road West Schoolhouse
Duxbury	Gershom Bradford House, 931 Tremont Street King Caesar House, King Caesar Road Nathaniel Winsor House, 479 Washington Street
Gloucester	Beauport, Eastern Pt. Blvd. Hammond Castle, 80 Hesperus Avenue
Hadley	Hadley Farm Museum, Russell Street Porter Phelps Huntinghouse, 130 River Drive
Haverhill	The Whittier House, 305 Whittier Road
Holyoke	Wisteriahurst, 238 Cabot Street
Ipswich	Castle Hill, Argilla Road
Lee	Merrell Tavern, Route 102
Lenox	Ventfort Hall, 104 Walker Street
Lexington	Buckman Tavern, 1 Bedford Street Sanderson House, 314 Massachusetts Ave. Monroe Tavern, 1332 Massachusetts Ave. Hancock-Clarke House, 26 Hancock Street.
Lincoln	The Grange, Codman Road
Lowell	Whistler House, Worthen Street
Lynn	Mary Baker Eddy House, 12 Broad Street
Lynnfield	Meetinghouse
Medford	Peak House, 347 Main Street
Milton	Dr. Amos Holbrook House, 203 Adams Street Daniel Vose House, 1370 Canton Avenue
Nantucket	Whaling Museum, Broad Street Fire Hose Cart House, 8 Gardner Street Greater Light, 8 Howard Court Old Gaol, 15 Vestal Street 1800 House, 4 Mill Street Old Mill, 50 Prospect Street Hawden House, 96 Main Street Nathaniel Macy House, 12 Liberty Street Thomas Macy Warehouse, 10 Straight Wharf Fair Street Museum, 7 Fair Street Quaker Meeting House, 7 Fair Street
New Bedford	Benjamin Rodman House, 50 North Second Street
New Salem	Whitaker-Clary House, Elm Street
Newbury	Tristram Coffin House, 16 High Road Spencer-Pierce-Little House, Little Lane
Newton	Jackson Homestead, 527 Washington Street
No. Andover	Parson Barnard House, Osgood Street
No. Easton	Old Colony Railroad Station, Oliver Street
Norwood	Fred Holland Day, 93 Bay Street

Orleans	French Cable Station, Cove Road
Oxford	Clara Barton Homestead, Clara Barton Road
Peabody	Gen. Gideon Foster House, 35 Washington Street
Pittsfield	Herman Melville House, 78 Holmes Road
Plymouth	Plymouth Antiquarian Society, 126 Water Street Harlow Old Ft. House, 19 Sandwich Street Pilgrim Hall, 75 Court Street Richard Sparrow House, 42 Summer Street
Quincy	Adams Academy, 8 Adams Quincy Homestead, 34 Butler Street Josiah Quincy House, 20 Muirhead Street
Randolph	Johnathan Belcher House, 360 N. Main
Reading	Parker Tavern, 103 Washington Street
Rockport	Old Castle, Castle Lane
Salem	House of 7 Gables, 46-54 Turner Street Essex Institute, Essex Street The Norbone House Witch Museum Crowningshield Bently, Essex Street Gardner-Pingree House, 128 Essex Street Gedney House, 21 High Street Cox House, 19 High Street
Sandwich	Hoxie House, 18 Water Street Eldred House, 4 Water Street Wing Fort House, Spring Hill Road
Sheffield	Col. John Ashley House, Cooper Hill Road
Shrewsbury	Gen. Artemas Ward Homestead, Main Street
Springfield	Alexander House, State Street George Walter Vincent Smith Art Museum
Swansea	The Luther Store, 160 Old Warren Road The Martin House, 22 Stoney Hill Road
Taunton Green	Old Colony Historical Society, 66 Church
	Parson Capen House
Waltham	Robert Treat Paine House, 577 Beaver Street
Watertown	Edmund Fowle House, 26 Marshall Street
Wenham	Claflin-Richard House, 132 Main
West Springfield	Josiah Day House, 70 Park Street
Weston	Gold Ball Tavern, Old Post Road
Woburn	Loammi Baldwin Mansion, 2 Alfred Street
Wilmington	Harden Tavern, 436 Salem Street
Worcester	Timothy Paine House, 140 Lincoln Street

National Historic Landmarks

Amesbury	John Greenleaf Whittier Home, 86 Friend Street
Boston	African Meeting House, 8 Smith Court Nichols House, 55 Mt. Vernon Street Brook Farm, 678 Baker Street (Rox.) Christ Church, 191 Salem Street Faneuil Hall, Dock Square 1st Harrison Gray Otis House, 141 Beacon Street Paul Revere House, 19 North Street
Concord	Ralph Waldo Emerson House, 28 Cambridge Tpk. The Old Manse Orchard House, 299 Lexington Road
Dedham	Fairbanks House
Deerfield	Old Deerfield Village Historic District
Hancock	Hancock Shaker Village
Harvard	Fruitlands, Prospect Street
Hingham	Old Ship Meetinghouse, Main Street
Ipswich	John Whipple House, 53 S. Main Street
Lexington	Hancock Clarke House, 35 Hancock Street
Marblehead	Jeremiah Lee House, Washington Street King Hooper Mansion, Hooper Street
Marshfield	Daniel Webster Law Office, Webster Street
Medford	Peter Tufts House, 350 Riverside Drive Isaac Royal House, 15 George Street
Milton	Capt. R. B. Forbes House, 215 Adams
Nantucket	Nantucket Historic District Jethro Coffin House, Sunset Hill
New Bedford	New Bedford Historic District
Newburyport	Caleb Cushing House, 98 High Street
Quincy	John Adams Birthplace, 133 Franklin Street John Quincy Adams Birthplace, 141 Franklin Street
Salem	Peabody Museum The Custom House, 178 Derby Street
Saugus	Scotch Boardman House, 117 Howard Street
Stockbridge	Chesterwood, Williamsville Road The Mission House, Main Street
Waltham	The Vale, Lyman Street Gore Place, 52 Gore Street
Woburn	Count Rumford Birthplace, 90 Elm Street
Worcester	American Antiquarian Society, 185 Salisbury Street

***Historic structures determined eligible for listing in the National Register of Historic Places not qualifying as totally preserved buildings (see Partially preserved buildings, 780 CMR 3409.0). Refer to*:**

1. National Register of Historic Places,
   U.S. Federal Register, February 1, 1978, Part II.
2. National Register of Historic Place (additions). Contact the Massachusetts Historical Commission at the Massachusetts Archives Building, 220 Morrissey Boulevard, Boston, MA 02125.

***Historic districts listed in the National Register of Historic Places. Refer to*:**

1. National Register of Historic Places,
   U.S. Federal Register, February 1, 1979, Part II.
2. National Register of Historic Place (additions). Contact the Massachusetts Historical Commission at the Massachusetts Archives Building, 220 Morrissey Boulevard, Boston, MA 02125.

Structures proposed for certification as partially preserved not listed in the national register of historic places. Refer to Massachusetts Historical Commission Inventory Forms.

Contact the Massachusetts Historical Commission at the Massachusetts Archives Building, 220 Morrissey Boulevard, Boston, MA 02125.

NON-TEXT PAGE

APPENDIX 120.Z

DESIGN AND CONSTRUCTION OF *TOWNHOUSES*

(Note: 780 CMR 120.Z is unique to Massachusetts)

780 CMR 120.Z101 GENERAL

120.Z101.1 Scope. The provisions of 780 CMR 120.Z shall govern the design, construction, repair, renovation, alteration, addition, demolition and change of use to *townhouses*.

780 CMR 120.Z102 DEFINITIONS

120.Z102.1 General. The following words and items shall, for the purposes of 780 CMR 120.Z and as used elsewhere in 780 CMR, have the meaning shown in 780 CMR 120Z102.

TOWNHOUSE. ***A single family dwelling unit constructed in a group of three or more attached units in which each unit extends from foundation to roof and with open space on at least two sides (Use classification is typically R-2 by nature of numbers of and nature of occupancy of dwelling units per 780 CMR 3.00). Note; Townhouses ("row housing") in Massachusetts, unlike one- and two-family dwellings, are subject to seismic design requirements but townhouses of no more than three stories in height are allowed, in certain other respects, to resemble one- and two-family homes.***

LOW-RISE RESIDENTIAL BUILDINGS. ***Any Residential use of up to three stories in height above grade, except hotels and motels.***

780 CMR 120.Z103 BUILDING PLANNING FOR TOWNHOUSES

120.Z103.1 Design and Construction. For design and construction purposes, *townhouses* shall be designed and constructed in accordance with the applicable requirements of 780 CMR 1.00 through 50.00: *The Massachusetts State Building Code*, 7th Edition, as applicable). The height and area restrictions of 780 CMR 5.00 generally and of 780 CMR T503, specifically, shall likewise apply.

> **Exception 1**. Energy conservation requirements for any new construction *low-rise residential building* including townhouses of no more than three stories in height (except hotels and motels) shall comply with the requirements of 780 CMR 61.00: *Energy Efficiency* of the Massachusetts Building Code for One- and Two-Family Dwellings, 7th Edition.
>
> **Exception 2**. For townhouses of no more than three stories in height, fire separation requirements between dwelling units shall comply with the requirements of 780 CMR 5302 of the Massachusetts Building Code for One- and Two-Family Dwellings or the fire separation requirements dictated by the building Construction Type, whichever is greater.
>
> **Exception 3**. For townhouses of no more than three stories in height, all required means of egress elements, including, but not limited to stair design and allowed widths, stair rise and run, hand rails and guardrails and required landings may comply with requirements of 780 CMR 51.00 through 100.00, as applicable. For townhouses of more than three stories in height the applicable egress element requirements of 780 CMR 1.00 through 50.00, are required.

NON-TEXT PAGE

INDEX

By section number

A

- ACCESS OPENINGS
  - Attic 1209.2
  - Crawl space 1202.1
  - Doors 711.3.2
  - Fire damper 716.4
  - Fire department 402.15
  - Mechanical appliances 1209.3
  - Refuse/laundry chutes 707.13.3
- ACCESSIBILITY . . . . Chapter 11
  - Airports E110
  - Bus stops and terminals E108
  - Customer service facility 1109.12
  - Detectable warnings 1109.9
  - Dining areas 1108.2.9
  - Dressing, fitting and locker rooms 3409.7.10
  - Dwelling units 1107.5.3.1
  - Egress 1007
  - Elevators . . . . 1109.6, Chapter 30, 3409.7.2
  - Entrances 1105, 3409.8.3
  - Existing buildings 1103.2.2, 3409, E109.4
  - Historic buildings 3409.8
  - Hotel guest rooms 1107.6.1, 3409.7.7
  - Lifts 1109.7
  - Parking and passenger loading facilities 1106
  - Performance areas 3409.7.6
  - Platform, raised E103.1
  - Ramps . . . . . . 1010, Chapter 11 3409.7.5, 3409.8.5
  - Route 1104, 1107.4.5, E109.3.1
  - Scoping E101.1
  - Signage 1110, E107
  - Sleeping accommodations 1107
  - Telephone E106
  - Toilet and bathing facilities 1109.2, 3409.7.9, 3409.8.4, E105.2
  - Treads and risers 1009
  - Wheelchair spaces 1108.2.2
- ACCESSIBLE MEANS OF EGRESS 1007
- ADMINISTRATION . . . . Chapter 1
- ADOBE CONSTRUCTION 2102.1, 2109.8
- AFFIDAVITS 1808.2.20
- AGRICULTURAL BUILDINGS (GROUP U) . 312.1, 1103.2.5, Appendix C
- AIR CONDITIONING (see MECHANICAL) 101 .4.3, 1606.2, 2801.1, 3006.2
- AIR INTAKES (YARDS OR COURTS) . . . 1206.3.2
- AIRCRAFT HANGARS 412.2
  - Aircraft paint hangars 412.4, 507.6
  - Basements 412.2.2
  - Construction exterior walls 412.2.1
  - Heliports and helistops 412.5
  - Residential 412.3
  - Unlimited height 504.1
- AIRCRAFT-RELATED OCCUPANCIES 412, 907.2.22
  - Airport traffic control towers 412.1
  - Egress 412.1.3
  - Fire detection systems, automatic 412.1.4, 907.2.22
  - Standby power 412.1.5, 2702.2.17
  - Type of construction 412.1.2
- AISLE
  - Assembly seating 1024
  - Check-out 1109.12.2, 3407.7.11
  - Converging 1024.9.3
  - Grandstands, reviewing stands and bleachers 1024.1
  - Obstructions 1024.9.6
  - Stairs, handrails 1024.11
  - Tents 3103.4
  - Width 1024.9.2
- ALARM SYSTEMS, EMERGENCY 908
- ALARMS, FIRE (see FIRE ALARM)
- ALARMS, VISIBLE 907.9.1
- ALARMS, VOICE
  - High-rise buildings 907.2.12.2
- ALTERATIONS
  - Accessibility 3409
  - Applicability of code 101.2
  - Building 3402
- ALTERNATE MATERIALS, DESIGN, AND METHODS 104.11
- ALTERNATING TREAD DEVICES 1009.10
  - Construction 1009.10.2
  - Galleries, catwalks, and gridirons 1014.6.1
- ALUMINUM . . . . 1404.5.1, 1604.3.5, Chapter 20
- AMUSEMENT BUILDING, SPECIAL 411
  - Emergency voice/alarm communications system 411.6
  - Exit marking 411.7
  - Fire detection, automatic 411.3
  - Interior finish 411.8
  - Smoke detection system 907.2.11
  - Sprinklers, automatic 411.4
- AMUSEMENT PARK BUILDING 303
- ANCHOR STORE
  - (see COVERED MALL BUILDINGS) 402.2
  - Construction type 402.6
  - Means of egress 402.4.3.1
  - Occupant load 402.4.1.3
- ANCHORAGE 1604.8
  - Concrete, seismic 1604.8.2
  - Masonry 1604.8.2
  - Wind load 1609.1.3
- APARTMENT HOUSES 310.1
- APPEALS 112
- ARCHITECT (see REGISTERED DESIGN PROFESSIONAL)
- ARCHITECTURAL TRIM 1406.2.2
- AREA, BUILDING . . . . Chapter 5
  - Basements 503.1.1
  - Enclosed parking garage 508.2, 508.3
  - Limitations 503, 505
  - Membrane structures 3102

  - Mezzanines ... 505.2
  - Mixed construction types ... 3102.6
  - Mixed occupancy ... 302.3
  - Modifications ... 506
  - Open parking garage ... 508.3, 508.7
  - Residential aircraft hangars ... 412.3.6, 504.1
  - Unlimited ... 503.1.4, 506.2.1, 507

- AREA BUILDINGS, UNLIMITED ... 507
- AREA OF REFUGE ... 1007.6
- ASSEMBLY OCCUPANCY (GROUP A) ... 303, 1024
  - Accessory ... 302.2.1
  - Aisles ... 1024.9
  - Bleachers (see BLEACHERS)
  - Fire ... 907.2.1
  - Grandstands (see GRANDSTANDS)
  - Interior finishes ... Table 803.4
  - Motion picture theatres ... 507.9
  - Panic hardware ... 1008.1.9
  - Reviewing stands (see REVIEWING STANDS)
  - Seating, smoke-protected ... 1024.6.2
  - Sprinklers ... 507.2, 903.2.1
  - Standby power systems ... 2702.2.1
  - Standpipes ... 905.3.2
- ATRIUM ... 404
  - Automatic sprinkler protection ... 404.3
  - Enclosure ... 404.5
  - Interior finish ... 404.7
  - Smoke control ... 404.4, 707.2, 909
  - Standby power ... 404.6
  - Use ... 404.2
- ATTACHED GARAGE ... 302.1.1, 406.2.9
- ATTIC
  - Access ... 1209.2
  - Combustible storage ... 413.2
  - Draftstopping ... 717.4
  - Insulation ... 719.3.1
  - Live load ... Table 1607.1
  - Unusable space fire protection ... 711.3.3
  - Ventilation ... 1203.2
- AUDITORIUM
  - Accessibility ... 1108.2
  - Foyers and lobbies ... 1024.4
  - Interior balconies and galleries ... 1024.5
  - Motion picture projection rooms ... 409
  - Stages and platforms ... 410
- AUTOMOBILE PARKING GARAGE (see GARAGE, AUTOMOBILE PARKING) ... 406
- AUTOMOBILE, REPAIR GARAGE (see GARAGE, REPAIR) ... 406.6
  - Floor surface ... 406.6.4
  - Gas-detection system ... 406.6.6, 908.5
  - Ventilation ... 406.6.3
- AUTOMOTIVE SERVICE STATION ... 406.5
- AWNINGS
  - Definition ... 202.1
  - Design and construction ... 3105.2
  - Drainage ... 3201.4
  - Live load ... 1607.11.2.4
  - Plastic ... 2606.10
  - Public right-of-way encroachments ... 3202.2.3, 3202.3.1

B

- BALCONIES ... 1013.5
  - Accessibility ... 1108.2.2.2
  - Construction requirements ... 1406.3
  - Egress, means of ... 704.2, 1013.5, 1015.3
  - Emergency escape ... 1025
  - Encroachments ... 3202.3.2
  - Exterior ... 1015.3
  - Guards ... 1012.1
  - Interior ... 1024.5
  - Live load ... Table 1607.1
  - Projection, combustible ... 1406.3
  - Seismic ... 2308.12.7
  - Travel distance ... 1015.3
- BARBECUES ... 2801
- BASEMENT (see UNDERGROUND BUILDINGS)
  - Aircraft hangars ... 412.2.2
  - Area modification ... 503.1.1, 506.1
  - Considered a story ... 502.1
  - Emergency escape ... 1025
  - Height modifications for ... 508.2, 508.3, 508.5
  - Prohibited ... 415.4, 415.5, 415.7.3.5, 415.9.5.2.2, 418.1
  - Rodent proofing ... Appendix F
  - Sprinklers ... 903.2.10.1
  - Waterproofing and dampproofing ... 1807
- BASEMENT WALLS
  - Concrete ... Table 1904.2.2(2), 1909.6.1, 1910.4.3.1
  - Loads ... 1805.5
  - Waterproofing ... 1807.1.1
- BAY AND ORIEL WINDOWS ... 1406.4
- BLEACHERS
  - Accessibility ... 1108.2
  - Egress ... 1024.1.1
  - Footboards ... 1024.1.1
- BLOCK (see CONCRETE BLOCK, GLASS BLOCK)
- BOARD OF APPEALS ... 112, Appendix B
  - Application for appeal ... B11.1
  - Alternate members ... B101.2.1
  - Board decision ... B101.4
  - Limitations on authority ... 112.2
  - Membership of board ... B101.2
  - Notice of meeting ... B101.3
  - Qualifications ... 112.3, B101.2.2
- BOILER
  - Exits ... 1014.3
  - Fire detection ... 907.2
- BOLTS
  - Anchors ... 1912, 1913, 2103.11.5, 2108
  - High strength, steel ... 1704.3.3
- BONDING, MASONRY . 2103.8, 2109.6, 2109.7.2.1
- BRICK (see MASONRY)
  - Calculated fire resistance ... 721.4
  - Foundations ... 1805.5
  - Veneer ... 1405.5, 1405.9

- BUILDING
  - Access, fire department 402.13, 402.15, 415.9.5.2.2, 909.21.2
  - Alterations 3403
  - Area (see AREA, BUILDING) .... Chapter 5
  - Demolition 3303
  - Existing .... Chapter 34
  - Height (see HEIGHT, BUILDING) .... Chapter 5
  - Occupancy classification .... Chapter 3
- BUILDING DEPARTMENT 103
- BUILDING OFFICIAL
  - Duties and powers 104
  - Qualifications A101.1
  - Records 104.7
  - Termination A101.4
- BUILT-UP ROOFS 1507.10
- BUSINESS OCCUPANCY (GROUP B) 304
  - Area modifications .... Table 503, 506
  - Corridors (see CORRIDORS) 1016
  - Educational above 12th grade 304.1
  - Fire alarm 907.2.2
  - Parking under 508.2, 508.7
  - Single exit 1018.2
  - Special provisions 508

C

- CABLES, STEEL STRUCTURAL 2207
- CALCULATED FIRE RESISTANCE (see FIRE RESISTANCE, CALCULATED)
- CANOPIES 3105
  - Fire district D102.2.8
  - Live load, uniform 1607.11.2.4
  - Materials 3105.3
  - Motor vehicle service stations 406.5.2
  - Permanent D1 02.2.8
- CARPET
  - Floor covering 804.2
  - Textile wall covering 803.6.1
  - Textile ceiling finish 803.6.2
- CEILING
  - Height 409.2, 909.20.4.3, 1205.2.2, 1208.2
  - Interior finish 803
  - Penetration of fire resistant assemblies 707, 712.4, 716.2, 716.6
  - Suspended acoustical 803.9.1.1
- CELLULOSE NITRATE FILM HANDLING . 1007.4
- CERAMIC TILE
  - Material requirements 2103.4
  - Mortar 2103.9
- CERTIFICATE OF OCCUPANCY 110
- CHILD CARE 305.2, 308.3.1, 308.5.2, 407.1
- CHIMNEYS 2111 Factory-built717.2.5, 2801
- CHURCHES
  - Classification 303
  - Door operations 1008.1.8
  - Egress 1024
  - Fire alarm 907.2.1
  - Interior finishes .... Table 803.5
  - Stair enclosure 1019.1, 1024.5.1
- CIRCULAR STAIRS 1009.7
- CLAY ROOF TILE 1507.3
- COAL POCKETS 415.7.1.6
- COLD STORAGE, INSULATION 2603.3, 2603.5
- COMBUSTIBLE DUSTS 415.7.1
- COMBUSTIBLE LIQUIDS 415.7.2
- COMBUSTIBLE MATERIAL
  - High-pile stock or rack storage 413.1. 91 0.2.3
  - In concealed spaces 413.2, 717.5
  - In Type I and Type II 603, 804.4
  - On exterior side of exterior wall 1406
- COMBUSTIBLE PROJECTIONS 704.2, 1406.3
- COMBUSTIBLE STORAGE 413, 910.2.3
- COMMON PATH OF EGRESS TRAVEL 1013.3
- COMPARTMENTATION
  - Underground buildings 405.4
  - Values 341 0.6.3
- COMPLIANCE ALTERNATIVES 3410
- COMPRESSED GAS 307.2, 41 5.9.7.2.2, 903.3.2
- CONCEALED SPACES 413.2, 717
- CONCRETE .... Chapter 19
  - Anchorage 1604.8.2, 1913
  - Calculated fire resistance 721.2
  - Conduits embedded in 1906.3
  - Construction documents 1901.4
  - Construction joints 1906
  - Curing 1905.11
  - Durability 1904
  - Exposure conditions 1904
  - Footings 1805.4
  - Formwork 1906
  - Foundation walls 1805.5
  - Inspections .... 1704.4, Table 1704.4
  - Materials 1707.4.1
  - Mixing 1905
  - Pipe columns, concrete-filled 1916
  - Pipes embedded in 1906
  - Placing 1905
  - Plain, structural 1909
  - Proportioning 1905.2
  - Quality 1905
  - Reinforced gypsum concrete 1915
  - Reinforcement 1907
  - Rodent proofing .... Appendix F
  - Roof tile 1507.3
  - Seismic provisions 1910
  - Shotcrete 1914
  - Slab, minimum 1911
  - Specifications 1903
  - Storage of materials 1903.7
  - Strength testing 1704.4.1, 1905.6
  - Wood support 2304.12
- CONCRETE MASONRY
  - Calculated fire resistance 721.3
  - Construction 2104
  - Design 2101.2
  - Surface bonding 2109.2.3
  - Testing 1714, 2105.2.2.1.2
  - Wood support 2104.1.6, 2304.12
- CONCRETE ROOF TILE 1507.3
  - Wind resistance 1609.7.3
- CONDUIT, PENETRATION PROTECTION 711.4, 712.3, 101 9.1.1
- CONFLICTS IN CODE 102.1

- CONSTRUCTION DOCUMENTS 106, 1603
  - Fire alarm and detection systems 907.1.1
  - Fire resistant joint systems 713
  - Floor live load 1603.1.1
  - Live loads posted 1603.3
  - Masonry 2101.3
  - Means of egress 106.1.2
  - Penetrations 712
  - Permit application 105.1
  - Retention 106.5
  - Review 106.3
  - Roof assemblies 1503
  - Roof live load 1603.1.2
  - Roof snow load 1603.1.3
  - Seismic 1603.1.5
  - Site plan 106.2
  - Soil classification and design load bearing capacity 1802.6
  - Special loads 1603.1.6
  - Wind load 1603.1.4
- CONSTRUCTION JOINTS
  - Concrete 1906.4
  - Shotcrete 1914.7
- CONSTRUCTION, PUBLIC PROPERTY Chapter 32
- CONSTRUCTION TYPES .... Chapter 6
  - Automobile parking garage .... Table 406.3.5, 508.2- 508.7
  - Classification 602
  - Combustible material in Type I and Type II construction 603
  - Covered mall buildings 402.6
  - Fire resistance .... Table 601, Table 602
  - Highrise 403.3.1
  - Underground buildings 405.2
- CONTRACTOR'S RESPONSIBILITIES 901.5, 1705.3
- CONTROL AREA 414.2
- CORNICES
  - Masonry 2104.2.1
  - Projection 704.2, 1406.3
  - Draftstopping 717.2.6
- CORRIDOR 1016
  - Dead end 1016.3
  - Elevation change 1003.5
  - Headroom 1003.2, 1003.3.1
  - HPM service 903.2.4.2
  - Walls 708.1
  - Width 1016.2
- CORRIDOR PROTECTION, EXIT ACCESS
  - Construction, fire protection .. 708.1, Table 1016.1
  - Doors 715.3
  - Interior finish .... Table 803.5, 804.4
  - Opening protectives .... Table 715.3
  - Return and exhaust air 716.5.4
- CORROSIVES 414.3
- COURTS 704.3, 1206
- COVERED MALL BUILDINGS 402
  - Emergency voice/alarm system 907.2.21
  - Standby power 2702.2.13
  - Standpipe system 905.3.3
- COVERED WALKWAY 3306.7
- CONVEYING SYSTEMS 3005
- CRAWL SPACE
  - Access 1209.2
  - Drainage 1807.1.2
  - Ventilation 1203.3
- CRYOGENIC FLUIDS .... Table 307.7, Table 414.5.1, Table 415.9.2.1.1

D

- DAMPERS (see FIRE DAMPERS, SMOKE DAMPERS) .... 716.2 - 716.5
- DAMPPROOFING AND WATERPROOFING . 1806
  - Required 1807.2, 1807.3
  - Subsoil drainage system 1807.4
- DAY CARE 305.2, 308.5
- DEAD END 1016.3
- DEAD LOAD 1606
  - Building materials 1606.1
  - Definition 1602.1
  - Footing design load 1805.4.1.1
  - Load combinations 1605
- DEFLECTION, STRUCTURAL 1604.3
- DEMOLITION 3303
- DIAPHRAGMS
  - Definition 1602.1, 1609.2
  - Irregularities, seismic .... Table 1616.5.1.1
  - Masonry construction 2109.2.1.3
  - Particleboard 2306.4.3
  - Seismic design 1620.2.5, 1620.4.3
  - Vertical gypsum board ...... 2504, Table 2306.4.5
  - Wood 2302.1, 2305, 2305.2, 2306.3
  - Wood structural panel 2303.1.4
- DOORS 1008
  - Access-controlled 1008.1.3.4
  - Emergency escape 1025
  - Fire (see OPENING PROTECTIVES) 715.3, 1019.1.1
  - Glass 715.3.6, 1405.12
  - Horizontal sliding 1008.1.3.3
  - Landings 1008.1.5
  - Locks and Latches (see LOCKS) 1008.1.8.3
  - Operation 1008.1.8
  - Panic and fire exit hardware 1008.1.9
  - Power operated 1008.1.3.2
  - Revolving 1008.1.3.1
  - Security grilles 1008.1.3.5
  - Side swinging 1008.1.2
  - Smoke barrier 709.5
  - Structural testing, exterior 1714.5
  - Thresholds 1008.1.6
  - To area of refuge 1007.6
  - Width 1008.1.1
- DRAFTSTOPPING
  - Attics 717.4
  - Floor-ceiling assemblies 717.3
- DRY CLEANING PLANTS 415.7.4
- DRYING ROOMS 417
- DUCTS AND AIR TRANSFER OPENINGS 704.14, 706.10, 716
- DUMBWAITERS 707.14

E

- EARTHQUAKE LOADS (see SEISMIC) 1613 - 1623
- EAVES (see COMBUSTIBLE PROJECTIONS and CORNICES)
- EDUCATIONAL OCCUPANCY (GROUP E) ... 305
  - Day care ... 305.2
  - Egress, special provisions ... 1008.1.9
  - Fire alarm ... 907.2.3
  - Manual fire alarm boxes ... 907.3
  - Panic hardware ... 1008.1.9
  - Special occupancy separation ... Table 302.3.3
  - Sprinkler system ... 903.2.2
- EGRESS (see MEANS OF EGRESS) ... Chapter 10
- ELECTRICAL ... Chapter 27
- ELEVATOR
  - Accessibility ... 1109.6
  - Car size ... 3002.4
  - Construction ... 707.14
  - Control values ... 341 0.6.14
  - Conveying systems ... 3005
  - Emergency operations ... 3002.3, 3002.5, 3003
  - High-rise ... 403.9
  - Hoistway enclosures ... 3002, 3005
  - Hoistway venting ... 3004
  - Lobby ... 707.14.1
  - Machine rooms ... 3006
  - Means of egress ... 1003.7, 1007.4
  - Number of elevator cars in hoistway ... 3002.2
  - Personnel and material hoists ... 3005.4
  - Seismic requirements ... 1621
  - Shaft enclosure ... 707.14
  - Signs ... 1007.7
  - Standby power ... 2702.2.5, 2702.2.18
- EMERGENCY COMMUNICATIONS
  - Area of refuge ... 1007.6
- EMERGENCY EGRESS OPENINGS
  - Window wells ... 1025
- EMERGENCY LIGHTING ... 1006.1
- EMERGENCY POWER
  - Exit signs ... 2702.2.3
  - Group I-3 ... 408.4.2, 2702.2.16
  - Hazardous ... 41 4.5.4, 41 5.9.10
  - High-rise, business and residential
    - Loads, underground buildings ... 405.10.1
  - Means of egress illumination ... 1006.3, 2702.2.4
  - Occupancies ... 403.10, 2702.2.14
  - Underground buildings ... 405.10
- EMPLOYEE
  - Qualifications ... A1 01
  - Termination of employment ... A1 01.4
- ENCLOSED, WALKWAY ... 3104
- ENCROACHMENTS INTO THE PUBLIC RIGHT OF WAY ... Chapter 32
- END-JOINTED LUMBER ... 2303.1.1
- ENERGY EFFICIENCY ... Chapter 13
- ENGINEER (see REGISTERED DESIGN PROFESSIONAL)
- EQUIVALENT OPENING FACTOR ... Figure 704.7
- ESCALATORS AND MOVING WALKS ... 3005
  - Floor opening protection ... 707.2
  - Illumination ... 2702.2.4
  - Prohibited as means of egress ... 1003.7
- EXCAVATION, GRADING AND FILL ... 1803
- EXISTING BUILDING
  - Accessibility ... 1103.2.2, 3408
  - Additions, alterations, or repairs ... 3403
  - Change of occupancy ... 3406
  - Escalator ... 3409.7.4
  - Flood resistant ... Appendix G
  - Historic ... 3407
  - Moved structures ... 3408
  - Rodent-proofing ... Appendix F
- EXIT (see MEANS OF EGRESS)
  - Aisles ... 1016
  - Aisles with tables ... 1013.4.2
  - Boiler rooms ... 1014.3
  - Construction ... 706.1
  - Corridors ... 1016
  - Courts ... 1023.5
  - Discharge ... 1023
  - Enclosure ... 1019.1
  - Fire resistance ... 706.3. 1019
  - Furnace rooms ... 1014.3
  - Horizontal ... 1021
  - Illumination ... 1006.1
  - Incinerator rooms ... 1014.3
  - Interior finish ... Table 803.5
  - Mezzanines ... 505.3, 1004.6
  - Number, minimum ... 1018.1
  - Passageway ... 1020
  - Path, common ... 1013.3
  - Refrigerated rooms or spaces ... 1014.5
  - Refrigeration machinery rooms ... 1014.4
  - Signs ... 1011
  - Travel distance ... 1015
  - Underground buildings ... 405.8
- EXIT ACCESS (see MEANS OF EGRESS) ... 1013
- EXIT DISCHARGE (see MEANS OF EGRESS) 1023
- EXIT PASSAGEWAY (see MEANS OF EGRESS) ... 1020
- EXIT SIGNS ... 1011
  - Area of refuge ... 1007.6
  - Special amusement buildings ... 411 .7
- EXPLOSIVES ... Table 414.5.1, Table 415.3.1, Table 41 5.3.2, Table 415.9
- EXTERIOR WALLS (see WALLS, EXTERIOR) ... 704, Chapter 14

F

- FACTORY OCCUPANCY (GROUP F) ... 306
  - Increase dead end distance ... 1016.3
  - Low hazard occupancy ... 306.3
  - Moderate hazard occupancy ... 306.2
  - Smoke and heat vents ... 910.2
  - Travel distance increase ... 1015.1
- FARM BUILDINGS ... Appendix C
- FASTENING, WOOD CONSTRUCTION ... 2304.9
- FEES, PERMIT ... 108
  - Application ... 105.1
  - Plan review ... 106.3
  - Refunds ... 108.6
  - Related fees ... 108.5
  - Work commencing before issuance ... 108.4

FENCES 312.1

FIBERBOARD 2303.1.5

FILL MATERIAL 1803.5

FINGER-JOINTED LUMBER (see End-Jointed Lumber)

FIRE ALARM AND DETECTION SYSTEMS
  Aerosol storage 907.2.16
  Assembly 907.2.1
  Audible alarm 907.9.2
  Battery room 907.2.23
  Construction documents 907.1.1
  Covered mall 907.2.20
  High-rise 907.2.12
  Lumber storage 907.2.17
  Occupancy requirements 907.2.1, 907.2.10
  Special amusement buildings 907.2.11
  Underground buildings 907.2.18, 907.2.19, 907.2.20
  Visible alarm 907.9.1

FIRE ALARM BOX, MANUAL 907.3

FIRE BARRIERS 706

FIRE COMMAND STATION 403.7, 403.8, 911

FIRE DAMPERS .... 716.2 - 716.5

FIRE DEPARTMENT ACCESS 402.15

FIRE DETECTION SYSTEM, AUTOMATIC
  Airport traffic control towers 412.1.4
  High-rise buildings 403.5
  Institutional occupancy 407.2.1, 407.2.3, 407.6
  Special amusement buildings 411.3

FIRE DISTRICT .... Appendix D

FIRE DOOR
  (see OPENING PROTECTIVES) 714, 1019.1.1

FIRE EXTINGUISHERS, PORTABLE 906

FIRE EXTINGUISHING SYSTEMS, NON-WATER BASED 904

FIRE PARTITION 602.4.6, 708, 716.5.4

FIRE PROTECTION
  Alarm, audible 907.9.2
  Alarm, emergency systems 908
  Alarms, visible 907.9.1
  Explosion control 414.5.1, 911
  Fire extinguishers, portable 906
  Glazing, rated 715.2
  Smoke and heat vents 415.6, 910
  Smoke control systems 909
  Sprinkler systems 903

FIRE PROTECTION SYSTEMS 901.2

FIRE RESISTANCE
  Calculated 721
  Conditions of restraint 703.2.3
  Ducts and air transfer openings 716
  Joint systems 713
  Prescriptive 720
  Ratings .... Chapter 6, 703, 704.5, 706
  Tests 703
  Thermal and sound insulating materials 719.1

FIRE RESISTANCE, CALCULATED 721
  Clay brick and tile masonry 721.4
  Concrete assemblies 721.2
  Concrete masonry 721.3
  Steel assemblies 721.5
  Wood assemblies 721.6

FIRE-RETARDANT-TREATED WOOD
  Awnings 3105.2
  Balconies 1406.3
  Canopies 3105.2
  Concealed spaces 717.5
  Fastening 2304.9.5
  Fire wall vertical continuity 705.6
  Partitions 603.1
  Platforms 410.4
  Roof construction .... Table 601, 705.6, 1505,
  Shakes and shingles 1505.6
  Veneer 1405.4

FIRE SEPARATION DISTANCE .... Table 602, 702
  Exterior walls 1406.2.1.1

FIRE SHUTTER (see OPENING PROTECTIVES) .... 715.1, Table 715.3

FIRE WALLS 705
  Combustible framing 705.7
  Exterior intersecting walls 705.5.1
  Fire-resistance rating 705.4
  Materials 705.3
  Openings, protected 705.8
  Structural stability 705.2

FIRE WINDOWS (see OPENING PROTECTIVES)
  FIREBLOCKING 717.2
  Chimneys 717.2.5, 2111.13, 2113.20
  Wood construction 717.2.1, 717.2.7, 1406.2.4
  Wood stairs 717.2.4

FIREPLACES, FACTORY-BUILT 2111.14.1

FIREPLACES, MASONRY
  Combustibles 2111.11, 2111.12
  General provisions 2111
  Hearth extension 2111.9, 2111.10
  Steel units 2111.6

FIREWORKS 307.3

FLAMESPREAD .... 802, Table 803.5

FLAMMABLE FINISHES 416
  Fire protection 416.4

FLAMMABLE AND COMBUSTIBLE LIQUIDS 415.7.2

FLAMMABLE SOLIDS 307.5, 415.1

FLASHING 1503.2, 1507.3.9, 1507.5.6, 1507.7.6, 1507.8.7, 1507.9.8, 1510.6
  Roof 1503.2
  Wall, veneer 1405.3, 1405.11.7

FLOOD-RESISTANT CONSTRUCTION .... 1403.6, 1612, Appendix G

FLOOR/CEILING (see FLOOR CONSTRUCTION)

FLOOR CONSTRUCTION (see FLOOR CONSTRUCTION, WOOD)
  Draftstopping 717.3
  Fire resistance 706.3, 711
  Live loads 1607.2, 1610
  Materials .... Chapter 6
  Penetration of fire-resistant assemblies .. 711.5, 712

FLOOR CONSTRUCTION, WOOD
  Beams and girders 2304.11.2.4, 2308.7
  Bridging/blocking 2308.8.5, 2308.10.6
  Diaphragms 2305.2
  Fastening schedule 2304.9.1
  Framing 602.4.2, 2304.4
  Glass 2409

  Joists 2308.8
  Sheathing 2304.7
FLOOR COVERING 804.1, 804.2
FLOOR FINISH, INTERIOR 804
FLOOR LEVEL AT DOORS 1008.1.4
FLOOR LOADS
  Certificate of occupancy 110.1
  Combination 1605
  Live 1607
  Posting 1603.1.1
  Soil pressures 1610
FLOOR OPENING PROTECTION
  (see VERTICAL OPENING PROTECTION)
FOAM PLASTICS 402.14.5
  Attics 719.3.1, 2603.4.1.6
  Cold storage 2603.4.1.2
  Concealed 603
  Crawl space 2603.4.1.6
  Density mall signs 402.14.5.1
  Doors 2603.4.1.7
  Exterior walls of multistory buildings 2603.5
  Interior finish 801.2.2, 2603.8, 2604
  Label/identification 2603.2
  Roofing 2603.4.1.5
  Siding backer board 2603.4.1.10
  Stages and platform scenery 410.3.7
  Surface burning characteristics 2603.3
  Thermal barrier requirements 2303.4, 2603.5.2
  Thickness 402.14.5.2
  Trim 805.3, 2604
  Walk-in coolers 2603.4.1.3
FOOD COURT 402.2
  Occupant load 402.4.1.4
FOOTBOARDS 1024.1.1
FOOTINGS AND FOUNDATIONS ... 1805, 1910.4.3.2
FORMWORK, CONCRETE 1906
FOUNDATION
  Basement floor and wall loads 1610
  Footing design 1801.2, 1805.4.1
  Pier 1808.2
  Pile (see PILE FOUNDATIONS) 1808.2
  Required for wood buildings 2308.6
  Rodent proofing .... Appendix F
  Seismic provisions 1808.2.23, 1910.4.3.1
  Soils investigation (see SOILS) ... 1802.2.1, 1802.4
  Special inspections 1704.4, 1704.8, 1704.9
  Waterproofing and dampproofing 1807
FOYERS
  Assembly occupancy 1024.4
  Covered mall 402.1
FRATERNITIES, classification 310
FURNACE ROOMS 1014.3

G

GALLERIES
  Assembly occupancy egress, means of ... 1014.6.1, 1024.5
  Stages 410.3.2, 1014.6
GARAGE, AUTOMOBILE PARKING 406.2
  Accessible provisions 1105.1.1, 1109
  Barriers, vehicle 406.2.4, 1607.7.3
  Beneath other occupancies 406.2.7, 508
  Construction type ... 406.3.3, Table 503, Table 601
  Enclosed 406.4
  Guards 406.2.3
  Occupancy separation 302.3, 508
  Occupancy separation private garage 302.3.2
  Occupant load .... Table 1004.1.2
  Open 406.3
  Sprinklers 903.2.9
  Underground 405
GARAGE, REPAIR 406.6
  Flammable gas detection system 406.6.6.3, 908.5
  Sprinklers 903.2.8.1
GARAGES, TRUCK AND BUS
  Live load 1607.6
  Sprinklers 903.2.9.1
GARAGES AND CARPORTS, PRIVATE 302.3.3, 406.1
  Area limitations 406.1.2
GATES 1008.2
GIFT SHOPS 304, 407.2.4
GIRDERS
  Fire resistance .... Table 601
  Materials .... Chapter 6
  Wood construction 2304.11.2.4, 2308.7
GLASS
  Dead loads 2404
  Fire doors 715.3.5
  Fire resistant walls 715.6.2
  Fire windows 715.4.7, 715.4.8
  Floors and sidewalks 2409
  Handrails and guards 2407
  Identification 2403.1
  Impact loads 2406.1, 2408.2
  Jalousies 2403.5
  Label/identification .. 715.3.5.1, 715.3.6.3, 715.4.9
  Louvered windows 2403.3
  Non wired 715.4.4
  Railings 2407
  Replacement 2401.2, 3405
  Safety 715.3.6.4, 2406
  Skylights 2405
  Sloped 2405
  Snow loads 2404
  Supports 2403.2
  Testing 1714.5, 2406.1, 2408.2.1
  Veneer 1405.11
  Vertical 2404.1
  Wind loads 2404
  Wired 715.4.3
GLASS BLOCK 2110
  Atrium enclosure 404.5
  Fire resistance 2110.1.1
  Hazardous locations 2406, 2406.3.1
  Material requirements 2103.5
GRADE (PLANE) 502
GRADE, LUMBER (see LUMBER) 2302.1
GRAIN ELEVATORS 415.7.1.5
GRANDSTANDS, REVIEWING STANDS and BLEACHERS 1024.1.1
  Accessibility 1108.2
  Definition 1002

- Exit signs 1011
- Live load .... Table 1607.1
- Occupant load 1004

GREENHOUSES
- Area .... Table 503
- Classification of 312.1
- Deflections .... Table 1604.3
- Membranes 3102.1
- Plastic 2606.11
- Roof live load 1607.11.2.1
- Sloped glazing 2405

GRINDING ROOMS 415.7.1.2

GROSS LEASABLE AREA (see COVERED MALL BUILDINGS) 402

GROUT 712.3.1, 712.4.1, 2103.10

GUARDRAILS, VEHICULAR 406.2.3, 1607.7.3

GUARDS 1012
- Equipment platform 505.5.3
- Glass 2406.3, 2407
- Grandstands, reviewing stands, and bleachers 1024.1.1
- Loads 1607.7
- Mechanical equipment 1012.5
- Opening limitations 1012.3
- Parking garage 406.2.3
- Plastic 2606.5
- Ramps 1010.10
- Residential 1012.2
- Screen porches 1012.4
- Structural design 1607.7
- System, defined 1002.1

GUTTERS 1503.4.1

GYMNASIUMS
- Live load .... Table 1607.1
- Occupant load 1004
- Special occupancy separation .... Table 303.3.2

GYPSUM .... Chapter 25
- Aggregate, exposed 2513
- Board .... Chapter 25
- Concrete, reinforced 1915
- Construction 2508
- Diaphragms 2305.2
- Draftstopping 717.3.1
- Exterior soffit .... Table 2506.2
- Fastening .... 2211.4.3, 2306.4.5.1.4, Table 2306.4.5, 2508.1
- Fire resistance .... 721 .2.1.4, 721 .6.2
- Fire-resistant joint treatment 2508.4
- Inspection 2503
- Lath 2507, 2510
- Lathing and furring for cement plaster .. 718, 2510
- Lathing and plastering 2507
- Materials 2506
- Plaster, interior 2511
- Plaster, exterior 2512
- Shear wall construction 2211, 2306.4, 2308.9.3, 2505
- Sheathing 2304.6.1, 2211
- Showers and water closets 2509
- Stucco 2510
- Veneer base 2507.2
- Veneer plaster 2507.2
- Vertical and horizontal assemblies 2504
- Wallboard .... Table 2506.2
- Water-resistant backing board 2506.2, 2509.1.2

H

HANDRAILS 1009.11, 1607.7
- Assembly aisles 1024.9
- Alternating tread devices 1009.10
- Glass 2407
- Grandstands, reviewing stands, bleachers 1024.1.1
- Graspability 1009.11.3
- Guards 1012
- Loads 1607.7
- Plastic 2606.5
- Projection 1009.11.5
- Ramps 1010.8
- Stairs 1009.11
- Walkway, site work 3306,2

HARDBOARD 1404.3.2, 2303.1.6

HARDWOOD
- Fastening 2304.9
- Quality 2303.3
- Thermal barriers 2603.4
- Veneer 1404.3.2

HAZARDOUS MATERIALS 414
- Control areas 414.2, 415.9.4.6
- Explosion control .... 414.5.1, Table 414.5.1, 415.7.1.4, 415.9.5.4
- Special provisions 415.4, 415.5
- Sprinklers .... Table 414.2.4, 415.5.2, 415.7.2.4
- Ventilation .... Table 414.2.4, 414.3, 415.7.2.8, 415.9.2.6, 415.9.4.3, 415.9.5.7, 415.9.6.3

Weather protection 414.6.1

HEAD JOINT, MASONRY
- Bonding pattern 2109.6.5
- Thickness 2104.1.2.1

HEADER, MASONRY, (BONDER) DEFINITION 2102

HEADROOM
- Means of egress 1009.2, 1010.5.2
- Stairs 1009.2

HEALTH CARE
- Clinics 304
- Hospitals 308

HEALTH-HAZARD MATERIALS 307.2

HEAT VENTS 415.6, 910

HEATING (see MECHANICAL)
- Aircraft hangars 412.2.4
- Parking garages 406.2.8
- Repair garages 406.6.5

HEIGHT, BUILDING .... Chapter 5
- Limitations 503
- Mixed construction types 503.1
- Modifications 504
- Roof structures 504.3

HEIGHT, STORY 502.1

HIGH PILED COMBUSTIBLE STORAGE 413, 907.2.14, 910.2.3

HIGH-HAZARD OCCUPANCY (GROUP H) 307, 415
- Classification 307
- Combustible liquids 415.7.2

  Control areas 414.2
  Conveyors 415.7.1.3
  Corrosives .... Table 414.2.4, 414.3
  Cryogenic fluids.. Table 414.5.1, Table 415.9.2.1.1
  Dispensing, use and handling 4 14.7.2
  Dry cleaning (see DRY CLEANING)
  Egress, special provisions 415.7.4
  Emergency alarm systems 908.1
  Exceptions 307.9
  Exempt 307.9
  Explosives .... Table 414.5.1, Table 415.3.1
  Factory industrial F-1 moderate hazard occupancy 306.2
  Factory industrial F-2 low hazard occupancy 306.3
  Fire alarm, manual 901.6.3
  Flammable liquids 415.7.2
  Flammable solids Grinding rooms 415.7.1.2
  Group H-1 .... 307.3
  Group H-2 .... 307.4
  Group H-3 .... 307.5, 415.8
  Group H-4 .... 307.6. 415.8
  Group H-5 .... 307.7, 415.9
  Health-hazard materials .... 415.2, Table 414.2.4, 415.4, 41 5.9.6.2, Table 415.9
  Height 415.4, 415.5
  Interior finishes 416.2.1, 416.3.1
  Irritants .... Table 414.2.4, Table 415.9
  Liquid, highly toxic and toxic 415.8.3, 908.3
  Location on property 415.3
  Multiple hazards 307.8
  Organic peroxides .... Table 415.3.2,
  Oxidizers, liquid and solid .. 414.5.4, 415.5.1, 415.6
  Permit drawings and specifications
  Pyrophoric materials 415.4.1, 415.5.1
  Sensitizers .... Table 415.9
  Separation from other occupancies .... Table 415.3.1, 415.7.3.4.1
  Solids, highly toxic and toxic .... 415.8.3, Table 415.9, 908.3
  Special provisions H-2, H-3 .... 415.4, 415.5
  Sprinklers 415.5.2, 415.7.2.4 415.9.6.3, 415.9.9, 415.9.10.1, 415.9.11, 704.8.1, 903.2.4
  Standby power systems .... 2702.2.9 - 2702.2.12
  Storage and dispensing 414.1, 414.5, 414.6
  Tank protection 415.7.2.2, 415.7.2.3
  Unstable materials .. Table 414.2.4, Table 414.5.1, Table 415.3.2, 415.5.1, 415.6, 415.9
  Water-reactive materials .... Table 414.5.1.2, Table 415.3.2, 415.5, 415.5.1, 415.5.2, 415.6, Table 415.9.5, 415.9

HIGH-RISE BUILDINGS 403
  Automatic fire detection 403.5, 907.2.12
  Automatic sprinkler system 403.2
  Elevators 403.9
  Fire command station 403.8
  Fire department communication 403.7
  Seismic 1614
  Smokeproof enclosure 1019.1.5
  Sprinklers 403.3, 903.3.1.1
  Stairway door operation 403.12
  Standby power, light and emergency systems 403.10, 2702.2.14
  Voice alarm 403.6, 907.2.12
  Zones 907.8.2

HORIZONTAL EXIT 1021
  Doors 1021.3
  Fire resistance 1021.2
  Institutional I-3 occupancy 408.2, 1021.1
  Institutional I-2 occupancy 1021.1

HORIZONTAL FIRE SEPARATION 704
  Combustible projections 704.2

HOSE CONNECTIONS (see STANDPIPES)

HURRICANE SHUTTERS 1609.1.4

I

INCINERATOR ROOMS 1014.3

INDUSTRIAL (FACTORY-INDUSTRIAL OCCUPANCY)

INSPECTIONS 109
  Approval required 109.6, 1704.1
  Atrium buildings 909.3
  Concrete slab 109.3.2
  EIFS 1704.12
  Energy efficiency 109.3.7
  Fees 108
  Final 109.3.10
  Fire-resistant materials 1707.11
  Fire resistant penetrations 109.3.6
  Footing or foundation 109.3.1
  Frame 109.3.4
  General 109.1
  Lath or gypsum board 109.3.5, 2503
  Liability 104.8
  Pier 1704.9
  Pile 1704.8, 1808.2
  Preliminary 109.2
  Reinforcing steel 1704.4
  Required 109.3
  Right of entry 104.6
  Seismic 1707
  Special 109.3.9, 1704.13
  Sprinklers 904.4
  Steel, structural 1704.3, 1704.11.3.2
  Steel framing, cold-formed 1704.3
  Third party 109.4
  Wall panels and veneers 1704.10
  Welding 1704.3, 2204.1
  Wood, structural 1704.6

INSTITUTIONAL I-1 .... 308.2
  Emergency egress 1025
  Fire alarm 907.2.6.1
  Visible alarms 907.9.1.3
  Sprinklers 903.2.5, 903.3.2

INSTITUTIONAL I-2
  Accessibility 1107.5.2
  Combustible decorations 805.1
  Corridor width 1016.2
  Exterior exit stair 1022.2
  Fire alarm and detection 907.2.6
  Special requirements 407
  Sprinklers 903.2.5, 903.3.2
  Suites 1013.2
  Openings in smoke barriers 909.5.2, 709.5

INSTITUTIONAL I-3 .... 308.4
  Exit sign exemption 1011.1
  Openings in smoke barriers 909.5.2
  Special requirements 408

INSTITUTIONAL I-4 .... 308.5
  Corridor rating 1016.1
  Fire alarm 907.2.6
  Sprinklers 903.2.5
INSTITUTIONAL OCCUPANCY (GROUP I) . . 308
  Child care 308.3.1
  Group I-1 .... 308.2
  Group I-2 .... 308.3, 407
  Group I-3 .... 308.4, 408
  Group I-4 day care facilities 308.5
  Sprinkler system, automatic 903.2.5
INSULATION
  Concealed 719.2
  Duct insulation 719.1
  Exposed 719.3
  Foam plastic (see FOAM PLASTIC
    INSULATION) 719.1
  Penetrations 712.3.4
  Roof 719.5
  Thermal 719
  Wall insulation 2303.1.5.2
INTERIOR ENVIRONMENT
  Lighting 1205
  Rodent proofing .... Appendix F
  Sound transmission 1207
  Space dimensions 1208
  Temperature control 1204
  Ventilation 1203.5
  Yards or courts 1206.2, 1206.3
INTERIOR FINISHES .... Chapter 8
  Acoustical ceiling systems 803.9
  Application 803.4, 804.4
  Atriums 404.7
  Decorative materials 801.1.2, 805
  Floor finish 804
  Foam plastic insulation 2603.4
  Foam plastic trim 805.3
  Light-transmitting plastics 2606
  Signs 402.13, 2611
  Wall and ceiling finishes 803
INTERPRETATION, CODE 104.1

J

JOINTS, FIRE-RESISTANT SYSTEMS 713

K

KIOSKS 402.10

L

LABORATORIES
  Classification of 302
  Hazardous materials 414
  Incidental use .... Table 302.1.1
  Live load .... Table 1607.1
LADDERS, FIRE ESCAPE 3404
LAMINATED TIMBER, STRUCTURAL
  GLUED 602.4, 2301.3
LANDINGS
  Doors 1008.1.5
  Ramp 1010.6
  Stair 1009.4, 3403.4
LATH, METAL OR WIRE .... Chapter 25
LAUNDRIES .... 304, Table 302.1.1
LAUNDRY CHUTE 707.13, 903.2.12.2
LEGAL (see LIABILITY)
  Federal and state authority 102.2
  Liability 104.8
  Notice of violation 113.2, 115.3
  Registered design professional 106.1, 106.3.4
  Right of entry 104.6
  Unsafe buildings or systems 115
  Violation penalties 113.4
LIBRARIES
  Other than school, classification 303.1
  School, classification 305.1
LIGHT, REQUIRED 1205.1
LIGHTING, EMERGENCY
  (see EMERGENCY LIGHTING)
LIGHTS, PLASTIC CEILING DIFFUSERS . . . 2606.7
LINTEL
  Adobe 2109.8.4.7
  Fire resistance 714.6
  Masonry 2104.1.5
  Masonry, wood support 2304.12
LIQUEFIED PETROLEUM GAS 415.7.3
LIVE LOAD 1607
  Deflections .... Table 1604.3
  Load Combinations 1605
LOADS
  Dead 1606
  Flood 1612
  Impact 1607.8
  Live 1603.3, 1607
  Pile foundation 1808,1811
  Rain 1611
  Seismic 1603.1.5, 1613- 1623
  Snow 1608
  Soil lateral 1610
  Structural .... Chapter 16
  Structural, combinations 1605
  Wind 1603.1.4, 1609
LOBBIES
  Assembly occupancy .... `1024.4
  Elevator 707.14.1
LOCKS AND LATCHES 1008.1.8.3
  Delayed egress locks 1008.1.8.6
  Institutional I-3 occupancy 408.4
LUMBER
  General provisions .... Chapter 23
  Quality 2302

M

MAINTENANCE Accessibility 1103.2.9
MALL (see COVERED MALL BUILDINGS)
MANUAL FIRE ALARM BOX 907.3
MANUFACTURED HOMES
  Flood resistant G501
MARQUEES 3106, H113

- MASONRY
  - Adhered veneer 1405.9
  - Adobe 2109.8.1 - 2109.8.3
  - Anchorage 1604.8.2, 2106.2, 2109.7
  - Anchored veneer 1405.5
  - Ashlar stone 2102
  - Bond 2109.6
  - Cavity wall 2109.4.2
  - Chimneys 2111
  - Cold weather construction 2104.3
  - Compressive stress requirements 2109.3
  - Construction 2104, 2109.8.4
  - Construction documents 2101.3
  - Corbelled 2104.2
  - Dampproofing 1807
  - Design, methods 2101.2, 2106 - 2109
  - Fire resistance, calculated 721 .3.2, 721 .3.4
  - Fireplaces 2101 .3.1, 2111
  - Floor anchorage 1604.8.2, 2109.7.3
  - Foundation walls 1805.5
  - Foundations adobe 2109.8.4.3
  - Glass unit 2101 .2.5, 2103.5, 2110
  - Grouted 2102
  - Headers (BONDERS) 2109.6.2
  - Hollow units 2104.1.2.2
  - Hot weather construction 2104.4
  - Inspection 1704.5
  - Joint reinforcement 2103.11.2, 2109.6.3.2, 2109.7.2.3
  - Lateral stability 2109.2
  - Lateral support 2106.2, 2109.4
  - Materials 2103
  - Parapet walls 2109.5.5
  - Penetrations 712, 712.3.1
  - Quality assurance 2105
  - Rodent-proofing Appendix F
  - Roof anchorage 1604.8.1, 2106.2, 2109.7.3
  - Rubble stone 2102
  - Running bond 2109.6.5
  - Seismic provisions 2106
  - Shear walls 2106.1.1
  - Solid 2104.1.2.3, 21 09.6.2.1
  - Stack bond 2109.6.5.2
  - Stone 2103.3, 2109.8
  - Support (see MASONRY, LATERAL SUPPORT) 2304.12
  - Surface bonding 2103.8
  - Test procedures 1711, 2105.2.2.2
  - Thickness 2109.5
  - Tie, wall 2104.1.3, 2109.6.3
  - Veneer 2101 .2.6, 2308.11.2
  - Wall, composite 2102.1
  - Wall, hollow 2102.1
  - Wall, intersecting 2109.7.2
  - Wall anchorage 1604.8.2, 2109.7
  - Waterproofing 1807
  - Weepholes 2104.1.8
  - Wetting brick 2104.5
  - Wythe defined 2102.1
- MATERIALS
  - Alternates 104.11
  - Aluminum Chapter 20
  - Concrete Chapter 19
  - Glass Chapter 24
  - Gypsum Chapter 25
  - Masonry Chapter 21
  - Noncombustible 703.4
  - Plastic Chapter 26
  - Steel Chapter 22
  - Testing (see TESTING) 1715
  - Wood Chapter 23
- MEANS OF EGRESS Chapter 10
  - Accessible 1007.1, 2702.2.5
  - Aisles 1013.4
  - Assembly 1024.2, Table 1024.6.2
  - Capacity 1005.2
  - Ceiling height 1003.2
  - Corridors 1016
  - Covered mall buildings 402.4
  - Doors 1008.1
  - Educational occupancy 308.5.2
  - Elevation change 1003.5
  - Elevators, escalators and moving walks 1003.7
  - Emergency escape and rescue 1025
  - Emergency lighting values 3410.6.15
  - Enclosures under stairways 1019.1.2
  - Exit access 1013
  - Exit components 1018.4
  - Exit discharge 1023
  - Exit doors 1017.2
  - Exit passageway 1020.1
  - Exit signs 1011
  - Floor surface 1003.4
  - Gates 1008.2
  - Grandstands 1024.5
  - Guards 1021.1
  - Helistops 1018.1.2
  - Illumination 1006.1
  - Minimum width 1005.2
  - Occupant load 1004.1
  - Path of egress travel, common 1013.3
  - Protruding objects 1003.3
  - Ramps 1010.1
  - Residential aircraft hangars 412.3.3
  - Seating at tables 1013.4
  - Stage 1014.6
  - Stairways 1009
  - Temporary structures 3103.4
  - Travel distance 1015.1, 1024.7
  - Values 3410.6.11
  - Vertical exit enclosures 1019.1
  - Width 1005.1, Table 1005.1, 1024.6, 1024.8
- MECHANICAL (see AIR CONDITIONING, HEATING AND REFRIGERATION, AND VENTILATION)
  - Air transfer openings 704.14, 705.11, 706.10, 716.4
  - Chimneys (see CHIMNEYS) 2113
  - Code Chapter 28
  - Equipment on roof 1509, 1510.2
  - Factory-built fireplace 2111.14.1
  - Fireplaces (see FIREPLACES) 2111.1
  - Permit required 105.1
  - Room separation 302.1.1
  - Seismic attachment 1621.1 .3
  - Seismic inspection and testing 1707.7
  - Smoke control systems 909
  - Systems Chapter 28
- MEMBRANE ROOF COVERINGS 1507.11, 1507.12, 1507.13
- MEMBRANE STRUCTURES 2702.2.8, 3102
- MENTAL HOSPITALS, CLASSIFICATION 308.3

- MERCANTILE OCCUPANCY (GROUP M)
  - Area 505, 506, 507
  - Classification 309
  - Height 504
  - Interior finishes Table 803.5
  - Sprinkler system, automatic 903.2.6
- METAL
  - Aluminum Chapter 20
  - Roof coverings 1504.3.2, 1507.5
  - Veneer 1404.5
- MEZZANINES 505
  - Accessibility 1108.2.4.1
  - Egress 505.3, 1004.6
  - Height modifications for 505.1
  - Stairs 707.2(9), 1009.10
- MIRRORS 1008.1, 2406.3.1(7)
- MIXED OCCUPANCY (see OCCUPANCY, MIXED AND OCCUPANCY SEPARATION)
- MOISTURE PROTECTION 1403.2, 1503 2303.2.3, 2304.11
- MONASTERIES, CLASSIFICATION 310.1
- MORTAR
  - Ceramic tile 2103.4
  - Compressive stresses, masonry Table 2103.7(2)
  - Dampproofing 1807
  - Fire resistance 712.3.1, 712.4.1
  - Glass block 2110.6
  - Material 2103.7
  - Placing 2104.1.2
  - Rodent-proofing Appendix F
  - Surface-bonding 2103.8
- MOTELS, CLASSIFICATION 310.1
- MOTION PICTURE PROJECTION ROOMS 409
  - Construction 409.2
  - Exhaust air 409.3.1.2
  - Lighting control 409.4
  - Projection room 409.3.1
  - Supply air 409.3.1.1
  - Ventilation 409.3
- MOTOR VEHICLE RELATED USE GROUPS 304, 311, 406
- MOVING, BUILDINGS D103.3
- MOVING WALKS, MEANS OF EGRESS 1003.7, 3005.2

N

- NAILING REQUIREMENTS 2304.9
- NONCOMBUSTIBLE BUILDING MATERIAL 703.4
- NURSING HOMES, CLASSIFICATION 308.3

O

- OCCUPANCY
  - Accessory 302.2
  - Atriums 404.2
  - Certificates (see CERTIFICATES OF OCCUPANCY)
  - Change 3405
  - Floor loads Table 1607.1
  - Special Chapter 4
- OCCUPANCY CLASSIFICATION
  - Covered mall buildings 402
  - HPM 415.9
  - Mixed 302.3
  - Mixed occupancy values 3410.6.16
  - Special Chapter 4
- OCCUPANCY SEPARATION
  - Covered mall building 402.7.3.1
  - Incidental use areas 302.1.1, 706.3.4
  - Parking garages Table 302.3.2©), 406.1.2, 406.2.7
  - Repair garages 406.6.2
  - Required fire resistance Table 302.3.3
  - Residential aircraft hangars 412.3.2
- OCCUPANT LOAD
  - Certificate of occupancy 110
  - Covered mall building 402.4.1
  - Determination of 1004.1
  - Increased 1004.2
  - Signs 1004.3
- OFFICE BUILDINGS, CLASSIFICATION OF 304
- OPENING PROTECTION, EXTERIOR WALLS 704.1
- OPENING PROTECTION, FLOORS (see VERTICAL OPENING PROTECTION)
- OPENING PROTECTION, INTERIOR WALLS
- OPENING PROTECTIVES 715
  - Automatic closing devices 715.3.2.7, 909.5.2
  - Fire door and shutter assemblies 715.7.3.8, 715.4
  - Fire windows 71 5.4.7, 715.4.8
  - Glass 715.4
  - Glass block (see GLASS BLOCK) 2110.1.1
  - Interior walls 708.6
  - Required fire resistance 715.3
  - Self-closing 715.3.7
- ORGANIC COATINGS 418
- ORGANIC PEROXIDES 307.4, 307.5
- OXIDIZERS, LIQUID AND SOLID 307.2

P

- PANIC HARDWARE 1008.1.9
- PARAPET, EXTERIOR WALL 704.11, 2109.5.5
  - Construction 704.11.1
  - Fire wall 704.11, 705.6
  - Height 704.11.1
- PARKING, ACCESSIBLE 1106
- PARKING GARAGES (see GARAGES, AUTOMOBILE PARKING) 406.2
  - Barriers, vehicle 406.2.4
  - Classification 406.2 1
  - Guards 406.2.3
  - Height, clear 406.2.2
  - Mixed separation 406.2.7
- PARKING GARAGES, OPEN 406.3
  - Area and height 406.3.5
  - Construction type 406.3.3
  - Stairs and exits 406.3.8
  - Standpipes 406.3.9
- PARKING GARAGES, ENCLOSED 406 4
  - Heights and areas 406.4.1
  - Ventilation 406.4.2

- PARTICLEBOARD
  - Draftstopping 717.3.1
  - Fastening 2304.9
  - Moisture protection 1403.2, 1405.1
  - Quality 2303.1.9
  - Seismic 2305
  - Shear walls 2306.4.3
  - Veneer 1405.4
  - Wall bracing 2308.9.3
- PARTITIONS
  - Materials 602.4.6, 603.1
  - Occupancy, specific 708.1
  - Seismic bracing 1621 .2.6.1
  - Structural 1607.13
- PARTITIONS, FIRE 708
  - Construction, general 703
  - Continuity 302.1.1.1, 708.4
  - Exterior walls Table 602, 704.5, 708.5
  - Fire resistance rating of walls 603.1(8), 708.3
  - Joint treatment gypsum 2508.4
  - Joints 713
  - Opening protection 715
  - Rated glazing 715.4
- PASSAGEWAY, EXIT (see EXIT) 1020.1
- PASSENGER STATIONS, CLASSIFICATION OF PATIO COVERS 303, 2606.10
- PEDESTRIAN
  - Protection at construction site 3306
  - Walkways and tunnels 3104
- PENALTIES 113.4
- PENETRATION-FIRESTOP SYSTEM
  - Fire-rated walls 712.3.2
  - Fire-rated horizontal assemblies 71 2.4.1.2
- PENETRATIONS 712
  - Fire partitions 708.7
  - Fire-resistant assemblies 712.3
  - Nonfire-resistant assemblies 712.4.3
- PERLITE Table 720.1(1), Table 2507.2
- PERMITS 105
  - Application for 104.2, 105.1, 105.3
  - Drawings and specifications 106.1.1
  - Expiration 105.5
  - Fees 108
  - Liability for issuing 104.8
  - Placement of permit 105.7
  - Plan review 104.2, 106.3
  - Suspension or revocation 105.6
  - Time limitations 105.3.2, 105.5
- PIER FOUNDATIONS 1808, 1812
- PILE FOUNDATIONS 1808
  - Base piles, enlarged concrete 1810.2
  - Caisson 1810.7
  - Composite 1811
  - Concrete, cast-in-place 1810
  - Concrete, precast 1809.2
  - Concrete-filled steel pipe and tube 1810.6
  - Drilled or augered uncased 1810.3
  - Driven 1809, 1810.4
  - Pile load, allowable 1808.2.8
  - Seismic design 1808.2.23, 1809.2.2.2.1 - 1809.2.3.2.2
  - Steel, structural 1809.3
  - Steel-cased 1810.5
  - Timber 1809.1
- PIPES
  - Embedded in concrete 1906.3
  - Embedded in fire protection 714.3
  - Insulation covering 719.7
  - Penetration protection 711, 716.5, 1019.2.1
  - Under platform 410.4
- PLAIN CONCRETE (see CONCRETE) Chapter 19
- PLAN REVIEW 106.3
- PLANT NURSERIES 304
- PLASTER
  - Fire resistance requirements 718
  - Gypsum 718.1, 718.2
  - Inspection 109.3.5
  - Portland cement 718.5, Table 2507.2, Table 2511.1
- PLASTIC Chapter 26
  - Approval for use 2606.2
  - Finish and trim, interior 2604
  - Light-transmitting panels 2607
  - Plastic, light-transmitting)
  - Roofing 2609
  - Signs 402.12, 2611, D102.2.10, H107
  - Thermal barrier 2603.4
  - Veneer 1404.8, 2605, D102.2.11
  - Walls, exterior 2603.5
- PLASTIC, FOAM INSULATION (see FOAM PLASTIC INSULATION) 2603
  - Interior finish 2604
  - Malls 402.14.5
- PLASTIC, LIGHT-TRANSMITTING
  - Awnings and patio covers 2606.10
  - Bathroom accessories 2606.9
  - Exterior wall panels 2607
  - Glazing 2608
  - Greenhouses 2606.11
  - Light-diffusing systems 2606.7
  - Roof panels 2609
  - Signs, interior 2611
  - Skylight 2610
  - Solar collectors 2606.12
  - Structural requirements 2606.5
  - Unprotected openings 2608.1, 2608.2
  - Veneer, exterior 603.1(1 5), 2605
  - Wall panels 2607
- PLATFORM 410
  - Construction 410.4
  - Temporary 410.4.1
- PLATFORM LIFTS, WHEELCHAIR 1007.5, 1109.7
- PLENUM
  - Underground buildings 907.2.18.1
- PLUMBING
  - Facilities, minimum 2902
  - Fixtures Table 2902.1
  - Residential aircraft hangars 412.3.5
- PLYWOOD
  - Bracing 2308.9.3
  - Decorative 2303.3
  - Design requirements 2301
  - Diaphragm 2305.2, 2306.3
  - Fastening 2304.9
  - Fire retardant treated 2303.2
  - Lateral loads, steel studs 2211.3, 2311.4.5
  - Preservative-treated 2303.1.8.1, 2304.11

  - Quality 2303
  - Roof sheathing 2304.7, 2308.10.8
  - Seismic shear panels . . 2305.1.5, 2305.3, 2308.12.4
  - Standards 2306.1
  - Subfloors 804.4.1
  - Veneer 1405.4
- PRESCRIPTIVE FIRE RESISTANCE 720
- PRESERVATIVE-TREATED WOOD
  - Fastenings 2304.9.5
  - Quality 2303.1.8
  - Required 1403.6, 2304.11
  - Shakes, roof covering 1507.9.5, 1507.9.7
- PROJECTION ROOMS
  - Motion picture 409
- PROJECTIONS, COMBUSTIBLE . . . 704.2.3, 1406.3
- PROPERTY LINE, ASSUMED (see FIRE SEPARATION) 704.3
- PROPERTY LINE, COMMON (see FIRE SEPARATION)
- PROSCENIUM
  - Opening protection 410.3.5
  - Wall 41 0.3.4
- PUBLIC ADDRESS SYSTEM
  - Covered mall building 402.13, 2702.2.1.3
  - Special amusement buildings . . . . 411 .6
  - Underground buildings 405.7
- PUBLIC PROPERTY . . . . . . Chapter 32, Chapter 33
- PUBLIC RIGHT OF WAY
  - Encroachments . . . . Chapter 32
- PYROPHORIC MATERIALS . . 307.4, Table 307.7(1)

R

- RAILING (see GUARDRAIL AND HANDRAIL)
- RAMPS 1010.1
  - Assembly occupancy 1024.10
  - Construction 1010.7
  - Existing buildings 3409.7.5
  - Parking garage 406.2.5
  - Slope 1010.2, 3409.8.5
- REFERENCED STANDARDS . . . . Chapter 35
  - Applicability 102.4
  - Fire resistance 703.2, 721.7
  - List . . . . Chapter 35
  - Organizations . . . . Chapter 35
- REFORMATORIES 308.4
- REFRIGERATION (see MECHANICAL)
  - System machinery room 1014.4
- REFUGE AREAS (see AREAS OF REFUGE)
- REFUSE CHUTE 707.13
- REINFORCED CONCRETE
  - General 1901.2
  - Inspections 1704.4
  - Seismic design 1910
- REINFORCEMENT
  - Concrete 1907
  - Glass block 2110.7
  - Masonry 2103.11
- REPAIRS, BUILDING
  - Minor 105.2.2
  - Permit required 105.1
- RESIDENT HOUSING AREA, INSTITUTIONAL I-3 OCCUPANCY
  - Accessibility 1107.5.5
  - Fire detection 907.2.6.2
  - Occupant load 1004.1.2
  - Subdivision 408.7
- RESIDENTIAL CARE/ASSISTED LIVING FACILITIES 308.1
  - Accessibility 1107.5.1
  - Fire alarms 907.2.6, 907.9.1.3
  - Separations . . . . Table 302.1.1, Table 302.3.2
  - Smoke Alarms 907.2.10.1.3
  - Sprinklers 903.2.5, 903.3.2
- RESIDENTIAL OCCUPANCY (GROUP R) 310
  - Accessibility 1107.6
  - Area . . . . Chapter 5
  - Doors 1008.1.1
  - Draftstopping 717.4.2
  - Emergency escape 1025.1
  - Height . . . . Chapter 5
  - Interior finishes . . . . Table 803.5
  - Parking under 508
  - Partitions 708.1
  - Smoke detectors 907.2.10
  - Sprinklers 903.2.7
  - Visible alarms 907.9.1.3
- RETAINING WALLS 1806
- REVIEWING STANDS
- Live load . . . . Table 1607.1
  - Occupant load 1004.7
  - Temporary 107
- RISERS, STAIR (see STAIRWAY CONSTRUCTION)
  - Closed 1009.3.2
  - General 1009.3
  - Institutional I-3 occupancy 1009.10
  - Open 1009.3.2
- RODENT-PROOFING . . . . Appendix F
- ROLL ROOFING 1507.6
- ROOF ACCESS 1009.12.1
- ROOF ASSEMBLIES AND ROOFTOP STRUCTURES
  - Cooling towers 1509.4
  - Drainage 1503.4
  - Fire classification 1505
  - Height modifications 504.3
  - Impact resistance 1504.7
  - Materials 1506
  - Parapet walls 1503.3
  - Penthouses 1509.2
  - Snow drift 1608.8
  - Tanks 1509.3
  - Towers, spires, domes and cupolas 1509.5
  - Weather protection 1503
  - Wind resistance 1504.1, 1609.7
- ROOF CONSTRUCTION
  - Construction walkways 3306.7
  - Coverings (see ROOF COVERINGS) 1609.7.2
  - Deck 1609.7.1
  - Draftstopping 717
  - Fire resistance . . . . Table 601
  - Fireblocking 717.2
  - Live loads 1607.11.2
  - Materials . . . . Chapter 6
  - Penetration of fire resistant assemblies 711.5
  - Projections 1608.8

  - Rain loads 1611
  - Roof structures 504.3, 1509, D102.2.9
  - Signs, roof mounted H 110
  - Slope, minimum Chapter 15
  - Snow load 1603.1.3
  - Wood (see ROOF CONSTRUCTION, WOOD)
- ROOF CONSTRUCTION, WOOD 602.4.5
  - Anchorage to masonry 1604.8.2, 2109.7.3.3
  - Attic access 1209.2
  - Ceiling joists 2308.10.2
  - Diaphragms 2305.2, 2306.3.2
  - Fastening schedule 2304.9
  - Framing 2304.10.3, 2308.10
  - Plank-and-beam 2306.1.2
  - Rafters 2306.1
  - Sheathing 2304.7, 2308.10.8
  - Trussed rafters 2308.10.7.1
  - Ventilation, attic 1203.2
  - Wind uplift 2308.10.1
- ROOF COVERINGS 1507
  - Asphalt shingles 1507.2
  - Built up 1507.10
  - Clay tile 1507.3
  - Concrete tile 1507.3
  - Fire resistance 1505
  - Flashing 1503.2, 1507.3.9, 1507.5.6
  - Impact resistance 1504.7
  - Insulation 1508
  - Liquid applied coating 1507.15
  - Membrane 3102
  - Metal panels 1507.4
  - Metal shingles 1507.5
  - Modified bitumen 1507.11
  - Plastics, light-transmitting panels 2609
  - Replacement/recovering 1510.3
  - Reroofing 1510
  - Roll 1507.6
  - Single-ply 1507.12
  - Slate shingles 1507.7
  - Sprayed polyurethane foam 1507.14
  - Thermoplastic single-ply 1507.13
  - Wind loads 1504.1, 1609.7
  - Wood shakes 1507.9
  - Wood shingles 1508.8
- ROOF DRAINAGE 1503.4
- ROOF PROTECTION FROM ADJACENT CONSTRUCTION 3307.1
- ROOF REPLACEMENT/RECOVERING 1510.3
- ROOF VENTS 1015.2
- ROOM DIMENSIONS 1207
- ROOMING HOUSE 310

S

- SAFEGUARDS DURING CONSTRUCTION Chapter 33
  - Adjoining property protection 3307
  - Construction 3302
  - Demolition 3303
  - Exits 3310
  - Fire extinguishers 3309
  - Protection of pedestrians 3306
  - Sanitary facilities 3305
  - Site work 3304
  - Sprinkler system, automatic 3312
  - Standpipes 3311
  - Temporary use of streets, alleys, and public property 3308
- SCHOOLS (see EDUCATIONAL OCCUPANCY)
- SECURITY GRILLES 1008.1.3.5
- SEISMIC 1613-1623
  - Concrete 1910
  - Loads 1614- 1622
  - Masonry 2106
  - Piers or piles 1808.2.23
  - Quality assurance 1705
  - Steel 2205
  - Soils investigation 1802.2.6, 1802.2.7
  - Structural observations 1707, 1709
  - Structural testing 1708
  - Ties, concrete footings 1805.4.2.2
  - Ties, pile foundation 1808.2.23
  - Wood 2305, 2308.11 - 2308.12
- SERVICE STATION 406.5
- SHAFT (see SHAFT ENCLOSURE AND VERTICAL OPENING PROTECTION) 702
- SHAFT ENCLOSURE (see VERTICAL OPENING PROTECTION) 707
  - Construction 707.11, 707.12
  - Elevators 707.14
  - Fire resistance rating 707.4
  - High-rise buildings 403.3.2
  - Materials 707.3
  - Penetrations 707.8, 716.5.3
  - Refuse and laundry chutes 707.12
  - Required 707.2
- SHEATHING
  - Clearance from earth 2304.11.2.2
  - Fastening 2304.9
  - Fiberboard 2306.4.4
  - Floor 2304.7, 2308.8.6
  - Gypsum 2306.4.5.1.6
  - Moisture protection 2304.11.2.2
  - Particleboard 2306.4.3
  - Roof 2304.7
  - Roof sheathing 2308.10.8
  - Wall 2304.6.1, 2308.9.3
  - Wood structural panels 2303.1.4,2211.3
- SHOPPING CENTERS 309
- SHOTCRETE 1914
- SHUTTERS, FIRE (see OPENING PROTECTIVES) 715.3
- SIDEWALKS 105.2(6)
- SIGNS 3107
  - Accessibility 1007.7, 1110, E107, E109.2.2
  - Animated devices H108
  - Area of refuge, accessible 1007.6.5, 1110.1
  - Covered mall building 402.14
  - Doors 1008.1.8, 1008.1.8.2
  - Electrical H106
  - Elevators 1109.6
  - Exit 1011.1,2702.2.3
  - Floor loads 1603.3
  - Ground H109
  - Height limitation H109.1, H112.4
  - Illumination H106.1.1
  - Marquee H113

  Occupant content, assembly ... 1004.3
  Parking spaces ... 1109.1
  Plastic ... 2611
  Portable ... H114
  Projecting ... H112
  Roof ... H110
  Stair identification ... 1019.1.4, 1110.2
  Standpipe control valve ... 905.7.1
  Wall ... H111
SITE DRAWINGS ... 106.2
SITE WORK ... 3304
SKYLIGHTS
  Light, required ... 1205.1
  Plastic ... 2610
  Protection from adjacent construction ... 3307.1
  Rated assemblies ... 711.4
SLAB, COMPOSITE STEEL
  DECK/CONCRETE ... 2209.2
SLAB ON GROUND, CONCRETE.. 1911, 2304.11.2.3
SLATE SHINGLES ... 1507.7
SMOKE BARRIERS ... 709, 71 6.5.4
  Construction ... 709.4, 909.5
  Doors ... 709.5, 715.3, 909.5.2
  Duct penetration ... 716.5.5
  Fire-resistance rating ... 709.3
  Materials ... 709.2
  Openings ... 709.5, 909.5.2
  Penetrations ... 709.6
  Required ... 407.4, 408.6
  Transfer grilles ... 716.5.5
  Walls ... 709.4
SMOKE CONTROL ... 909
  Atrium buildings ... 404.4
  Covered mall building ... 402.9
  High-rise ... 1019.1.5
  Stages ... 410.3.7.2
  Standby power systems ... 2702.2.2
  Systems ... 909
  Underground buildings ... 405.5, 907.2.19
  Values ... 3410.6.10.1
SMOKE DAMPERS ... 716.2 - 716.5
  Smoke barriers ... 716.5.4, 716.5.5
SMOKE DETECTORS
  Covered mall ... 907.2.20
  Elevator lobbies ... 907.2.18.1
  High-rise buildings ... 403.5, 907.2.12
  HPM ... 415.9.9
  Institutional I-2 ... 407.6
  Multiple-station ... 907.2.10
  Residential aircraft hangars ... 907.2.21
  Residential occupancies ... 907.2.10.1
  Single-station ... 907.2.10
  Smoke activated doors ... 715.3.7.3
  Special amusement buildings ... 411.5
  Underground buildings ... 907.2.18
SMOKE EXHAUST SYSTEMS
  Underground buildings ... 405.5, 907.2.18, 909.2.1
SMOKE VENTS ... 415.6, 910
SMOKEPROOF ENCLOSURES ... 1019.1.5
  Design ... 909.20.3
SNOW LOAD ... 1608
  Glass ... 2404
SOILS AND FOUNDATIONS ... Chapter 18
  Classification ... 1802.3
  Depth of footings ... 1805.2
  Excavation, grading and fill ... 1803
  Expansive ... 1802.3.2, 1805.8
  Footings and foundations ... 1805
  Footings on or adjacent to slopes ... 1805.3
  Foundation walls ... 1805.5
  Foundations, pile and pier ... 1808
  Grading ... 1803.3
  Investigation ... 1802
  Investigation, pile and pier ... 1802.2.4
  Investigation, seismic ... 1802.2.6,1802.2.7
  Loadbearing values ... 1804
  Soil boring and sampling ... 1802.5
  Soil lateral load ... 1610
  Testing, piles ... 1808.2.8.3
SOUND TRANSMISSION ... 1207
SPECIAL CONSTRUCTION ... Chapter 31
SPIRAL STAIRS ... 1009.9
  Stages ... 410.5.4
SPRAY-APPLIED FIRE RESISTANT MATERIALS
  Inspection ... 1704.11
  Steel column calculated fire resistance ... 721.5.2.2
SPRINKLER SYSTEMS, AUTOMATIC ... 903
  Exempt locations ... 903.3.1.1
  Substitute for fire rating ... Table 601(d)
  Values ... 3410.6.17
SPRINKLERS, REQUIRED ... 903
  Aircraft hangars ... 412.2.6
  Aircraft paint hangers ... 412.4
  Atrium building ... 404.3
  Basements ... 903.2.10.1
  Covered mall building ... 402.8
  Garages ... 406.3.10, 903.2.8
  Hazardous occupancies ... 903.2.4
  High-rise buildings ... 403.2, 903.2.10.3
  Incinerator rooms ... Table 302.1.1
  Laundry chutes, refuse chutes, termination
    rooms and incinerator rooms 707.12, 903.2.10.2
  Multistory buildings ... 903.2.10.3
  Spray finishing booth ... 416.4
  Supervision (see SPRINKLER SUPERVISION) 903.4
  Underground buildings ... 405.3
SPRINKLERS, SUPERVISION ... 903.4
  Service ... 901.6
  Underground buildings ... 405.3
STAGES AND PLATFORMS ... 410
  Alternating tread stairway ... 410.5.4
  Dressing rooms ... 410.5
  Egress ... 410.5.4, 1014.6
  Fire barrier wall ... 410.5.1
  Floor finish and floor covering ... 804.3
  Platform, temporary ... 410.4.1
  Platform construction ... 410.4
  Proscenium curtain ... 410.3.5
  Proscenium wall ... 410.3.4
  Roof vents ... 410.3.7.1
  Scenery ... 410.3.6
  Smoke control ... 410.3.7.2
  Special provisions
  Sprinkler system, automatic ... 410.6
  Standpipes ... 410.7
  Ventilation ... 410.3.7

STAIRWAY (see ALTERNATING TREAD, STAIRWAY, AND STAIRWAY CONSTRUCTION, AND STAIRWAY ENCLOSURE)
  Exterior exitway 1022.1, 1023.1
  Identification 1019.1.4
  Width, minimum 1009.1

STAIRWAY CONSTRUCTION
  Aisle 1024.9.2
  Alterations 3403.4
  Alternating tread 1009.10
  Circular 1009.7
  Elevators 3002.7
  Enclosure under 1019.1.5
  Fireblocking 717.2.4
  Handrails 1009.11
  Headroom 1009.2
  Illumination 1205.4
  Landings 1009.4
  Projections 1009.11.7
  Spiral 408.3.3, 1009.9
  Treads and risers 1009.3
  Width 1009.1
  Winders 1009.8

STAIRWAY ENCLOSURE
  Access 1019.1.8.2
  Construction 1019.1.2
  Discharge 1023.1
  Doors, automatic closing 715.3.7
  Elevators within 3002.7
  Fire resistant construction 1019.1.2
  Penetrations 1019.1.2
  Space below, use 1019.1.2
  Ventilation 1019.1.3

STANDBY POWER
  Atriums 404.6
  Covered mall building 402.12
  Elevators 3003.1
  Group I-3 .... 408.4.2
  Hazardous occupancy 414.5.4
  High-rise 403.10
  Stages 410.3.7.2, 909.11
  Underground buildings 405.9.1

STANDPIPE AND HOSE SYSTEMS (see STANDPIPES, REQUIRED) 905
  Dry 905.8
  Hose connection location .... 905.1, 905.4 - 905.6
  Locks 905.7.2

STANDPIPES, REQUIRED
  Assembly 905.3.2, 905.5.1
  Covered mall buildings 905.3.3
  During construction 905.10
  Stages 905.3.4
  Underground buildings 405.11, 905.3.5

STATE LAW 102.2

STEEL .... Chapter 22
  Bolting 2204.2.1
  Cables structures 2207
  Calculated fire resistance 721.5
  Cold-formed 2205, 2211
  Conditions of restraint 703.2.3
  Deck/concrete composite slabs 2209.2
  High strength bolts 1704.3.3
  Identification and protection 2203.1
  Inspection, concrete reinforcement 109.3.1
  Joists 2206
  Lateral resistance, steel stud walls 2211
  Open web joist 2206
  Parapet walls 1503.3
  Piles 1809.3
  Reinforcement, concrete 1907
  Seismic provisions .... 2205 - 2211
  Storage racks 2208
  Structural 2205
  Studs/gypsum wallboard 2211.2.2.3
  Studs/wood structural panel 2211.2.2.2
  Welding 2204

STONE VENEER 1405.6
  Slab-type 1405.7

STOP WORK ORDERS 114

STORAGE OCCUPANCY (GROUP S) 311
  Area .... Chapter 5
  Automobile parking garage 406
  Floor loads .... Table 1607.1
  Hazard storage, Group S-1, moderate 311.2
  Hazard storage, Group S-2, low 311.3
  Height .... Chapter 5
  High piled combustible 413
  Interior finishes .... Table 803.5
  Smoke and heat vents 910.2
  Sprinkler system, automatic 903.2.9
  Travel distance increase 1015.2

STRUCTURAL DESIGN
  Aluminum .... Chapter 20
  Concrete .... Chapter 19
  Foundations .... Chapter 18
  Masonry .... Chapter 21

STRUCTURAL FRAME INSPECTION 109.3.4

STRUCTURAL LOAD COMBINATIONS 1605

STRUCTURAL TESTS AND SPECIAL INSPECTIONS .... Chapter 17
  Alternative test procedure 1711
  Approvals 1703
  Design strengths of materials 1710
  General 1701
  In-situ load tests 1713
  Material and test standards 1715
  Preconstruction load tests 1714
  Quality assurance 1705, 1706
  Special inspections 1704, 1707
  Structural observations 1709
  Structural testing 1708
  Test safe load 1712

STRUCTURES, EXISTING .... Chapter 34
  Accessibility 3409
  Additions, alterations or repairs 3403
  Change of occupancy 3406
  Glass replacement 3405
  Historic buildings 3407
  Maintenance 3409.2
  Moved structures 3408
  Unsafe 115

STUCCO 2512

SWIMMING POOL, GLASS 2406.3

SWIMMING POOL, ENCLOSURES .... Chapter 31
  Gates, access 3109.4.1.7
  Indoor 3109.4.3
  Public 3109.3

  - Residential 3109.4

T

- TELEPHONE EXCHANGES CLASSIFICATION 304
- TEMPORARY STRUCTURES 3103
  - Certificate of occupancy 107.3
  - Conformance 107.2
  - Permit 107.1
  - Power, temporary 107.3
  - Structures 3103
  - Termination of approval 107.4
- TENANT SEPARATION
  - Covered mall buildings 708.1
- TENTS
  - Temporary 2702.2.8
- TERMITE, PROTECTION FROM 2304.11
- TERRA COTTA 1405.8
- TESTING
  - Building official required 104.11.1
  - Concrete 1905.6.2.4, 1905.6.5.2
  - Fire-resistant materials 703.2
  - Glass 2406
  - Roof tile 1715.2
  - Seismic 1708
  - Smoke control, atrium buildings 909.3
  - Soils 1802
  - Sprinklers 904.4
  - Structural Chapter 17
- THEATERS (see PLATFORM, AND PROJECTION ROOMS, AND STAGES) 303
- THERMAL BARRIER, FOAM PLASTIC INSULATION 2603.5.2
- THERMAL-AND SOUND-INSULATING MATERIALS 719
- Cellulose loose-fill insulation 719.6
- Loose-fill insulation 719.4
- Roof insulation 719.5
- THROUGH-PENETRATIONS
  - Air ducts 716.6.1
  - Fire barriers 706.8
  - Fire rated walls 712.3.1
  - Fire-rated horizontal assemblies 712.4.1
  - Firestop system 712.3.1.2, 712.4.1.2
- TILE
  - Ceramic, (see CERAMIC TILE)
  - Fire resistance, clay or shale 720.1
- TOILETS
  - Accessible 1109.2
  - Grab bars 1607.7.2
  - Rooms openings 1210.5
  - Unisex 1109.2.1
- TOWERS
  - Airport traffic control 412.1
  - Construction 3108.3
  - Dead load 3108.4.1
  - Grounding 3108.5
  - Location and access 3108.2
  - Radio 3108
  - Television 3108
  - Wind load 3108.4.2
- TOWERS, COOLING 1509.4
- TOXIC MATERIALS
  - Classification 307.6
  - Gas detection system 908.3
  - Separation 415.8.3
- TRAVEL DISTANCE
  - Factory-industrial occupancy, increase 1015.2
  - Mall 402
  - Mall tenant space 402.4.4
  - Measurement 1015.1
  - Storage occupancy, increase 1015.2
- TREADS, STAIR (see STAIRWAY CONSTRUCTION)
- TRUSSES
  - Fire resistance 714.2.3
  - Materials Chapter 6
  - Metal-plate-connected parallel wood 2303.4
  - Trussed rafters 2308.10.7.1
- TUNNELED WALKWAY 3104

U

- UNDERGROUND BUILDINGS 405
  - Compartmentation 405.4
  - Construction type 405.2
  - Elevators 405.4.3
  - Emergency power loads 405.10
  - Exits 405.8
  - Fire alarm systems 405.6
  - Public address 405.7
  - Smoke exhaust 405.5.2, 907.2.19
  - Smokeproof enclosure 1019.1.8
  - Sprinkler system, automatic 405.3
  - Standby power 405.9, 2702.2.15
  - Standpipe system 405.11
  - Voice alarms 907.2.19
- UNSAFE STRUCTURES AND EQUIPMENT (see STRUCTURES, UNSAFE) 115
  - Appeals 112, Appendix B
  - Restoration 115.5
  - Revocation of permit 105.6
  - Stop work orders 114.1
  - Utilities disconnection 111.3
- UNSTABLE MATERIALS 307.3
- UNUSABLE SPACE 711.3.3
- USE AND OCCUPANCY Chapter 3
  - Accessory 302.2
  - Incidental 302.1.1, Table 302.1.1
  - Mixed 302.3
- UTILITIES 111
  - Service connection 111.1
  - Service disconnection 111 .3
  - Temporary connection 111.2
- UTILITY AND MISCELLANEOUS OCCUPANCY (GROUP U) 312
  - Agricultural buildings Appendix C
  - Egress illumination 1011.2
  - Sprinkler system, automatic 903.2.10

V

- VALUATION OR VALUE (see FEES) 108.3
- VAPOR RETARDER 1403.3

- VEHICLE SHOW ROOMS . . . 304
- VENEER
  - Glass . . . 1405.11
  - Cement plaster . . . 1405.14
  - Masonry, adhered . . . 1405.9
  - Masonry, anchored . . . 1405.5
  - Metal . . . 1405.10
  - Plastic . . . 2605
  - Vinyl . . . 1405.13
  - Wood . . . 1405.4
- VENTILATION (see MECHANICAL)
  - Attic . . . 1203.2, 2308.10.10
  - Bathrooms . . . 1203.4.2.1
  - Crawl space . . . 1203.3
  - Elevator hoistways . . . 3004
  - Enclosed parking garages . . . 406.4.2
  - Exhaust, hazardous . . . 1203.5
  - Exhaust, HPM . . . 415.9.10.2
  - Exit enclosure . . . 1019.1.8.1
  - Fabrication areas, HPM . . . 415.9.2.6
  - Hazardous, storage and dispensing . . . 414.3
  - High-rise . . . 1019.1.8
  - HPM Service Corridors . . . 415.9.4.3
  - Mechanical . . . 1203.1
  - Natural . . . 1203.4
  - Projection rooms . . . 409.3
  - Repair garages . . . 406.6.3
  - Smokeproof enclosures . . . 909.20.3, 909.20.5
  - Stages . . . 410.3.7
  - Under-floor ventilation . . . 1203.3
- VENTS, PENETRATION PROTECTION . . . 712
- VERMICULITE, FIRE RESISTANT . . . 720
- VERTICAL OPENING PROTECTION
  - Atriums . . . 404.5
  - Duct penetrations . . . 716.1
  - Elevators . . . 707.14
  - Institutional I-3 occupancy . . . 408.5
  - Shaft enclosure . . . 707
  - Value . . . 3410.6.6.1
- VESTIBULES, EXIT DISCHARGE . . . 1023.1
- VINYL
  - Expanded . . . 802, 803.7
  - Rigid . . . 1405.13
- VIOLATIONS . . . 113
- VOICE ALARM (see also ALARMS, VOICE)
  - Amusement buildings, special . . . 411.6
  - Covered mall buildings . . . 402.13
  - High-rise buildings . . . 907.2.12
  - Underground buildings . . . 907.2.19.1

W

- WALKWAY, COVERED, ENCLOSED AND TUNNELED WALLBEARING . . . 3104
  - Fire resistance . . . Table 601
  - Materials per construction type . . . Chapter 6
  - Opening protection . . . 715
- WALL, EXTERIOR . . . 704
- Bearing . . . Chapter 6
- Coverings . . . 1405
  - Fire-resistance ratings . . . 704.5, 706, 1403.5
  - Flashing, veneered walls . . . 1405.3
  - Foam plastic insulation . . . 2603.4.1.4, 2603.5
  - Light-transmitting plastic panels . . . 2607
  - Materials . . . 704.4, 1406
  - Nonbearing . . . Chapter 6
  - Opening protection . . . 704
  - Projections . . . 704.2
  - Structural stability . . . 704.6
  - Vapor retarder . . . 1403.3
  - Veneer (see Veneer) . . . 1405.4, 1405.5, 1405.6, 1405.10
  - Weather resistance . . . 1403.2, 1405.2
  - Weather resistant barriers . . . 1405.2
- WALL, FIRE (see FIRE WALL)
- WALL, FIRE RESISTANT, PENETRATIONS . . . 712.3
- WALL, FOUNDATION . . . 1805.5
- WALL, INTERIOR
- Opening protection . . . 715
- WALL, INTERIOR NONBEARING (see PARTITION)
- WALL, MASONRY
  - Lateral stability . . . 2109.2
  - Lateral support . . . 2109.4, 2106
  - Shear . . . 2109.2.1.2
  - Wood contact . . . 2304.11.2.3, 2304.11.2.4
- WALL, PARAPET . . . 704.11, 1503.3, 2109.5.5
- WALL, PARTY (see FIRE WALLS) . . . 705.1
  - Fire resistance . . . 705
- WALL, RETAINING . . . Chapter 18, 2304.11.7
- WALL, VENEERED (see VENEER) . . . Chapter 14
- WALL, WOOD CONSTRUCTION
  - Bracing . . . 2308.9.3
  - Cutting, notching, boring . . . 2308.9.10
  - Exterior framing . . . 2308.9
  - Fastening schedule . . . 2304.9
  - Framing . . . 2304.3, 2308.9.2
  - Interior bearing partition . . . 2308.9.1
  - Interior nonbearing partition . . . 2308.9.2.3
  - Opening, framing . . . 2308.9
  - Seismic provisions . . . 2305, 2306, 2308
  - Shear walls . . . 2305.3, 2306.2
  - Sheathing (see SHEATHING)
  - Studs . . . 2306.2, 2308.9.1
  - Top plates . . . 2308.9.2.1
- WALL SIGNS . . . H111
- WATER-REACTIVE MATERIALS . . . Table 307.7(1)
- WEATHER, COLD
  - Concrete construction . . . 1905.12
  - Masonry construction . . . 2104.3
- WEATHER, HOT
  - Concrete construction . . . 1905.13
  - Masonry construction . . . 2104.4
- WEATHER PROTECTION
  - Exterior walls . . . 1405.2
  - Roofs . . . 1503
- WEEPHOLES . . . 2104.1.8
- WELDING, STEEL . . . 1704.3.1
- WIND BORNE DEBRIS . . . 1609.1.4
- WIND LOAD . . . 1609
  - Exposure category . . . 1609.4
  - Glass . . . 2404.1
  - Glass block . . . 2110.3.1
  - Roofs . . . 1504.1, 1609.7, 2308.10.1
  - Wind-borne debris . . . 1609.1.4

WINDERS, STAIR (see STAIRWAY CONSTRUCTION)

WINDOW 1025
  Emergency egress 1025
  Exterior, structural testing 1714.5
  Fire (see OPENING PROTECTIVES) 715.4.7, 715.4.8
  Glass (see GLASS) 1405.12
  Operable 1109.13.1
  Required, light and ventilation 1205.2
  Wells 1025.5

WIRES, PENETRATION PROTECTION 712

WOOD . . . . Chapter 23
  Assemblies, calculated fire resistance 721.6
  Bracing, walls 2308.9.3
  Ceiling framing 2308.10
  Connections and fasteners 2304.9
  Contacting concrete, masonry, or earth . . 2304.11.4
  Decay, protection against 2304.11
  Diaphragms 1620.2, 2306.3
  Draftstopping 717.3, 717.4
  End-jointed lumber . . . . 2303.1 .1
  Fiberboard 2303.1.5, 2306.4.4
  Fire retardant treated 2303.2
  Fireblocking 717.2
  Floor and roof framing (see FLOOR CONSTRUCTION, WOOD) 2304.4
  Floor sheathing 2304.7
  Foundation 1805.4.6, 2308.3.3.1
  Grade, lumber 2303.1.1
  Hardboard 2303.1.6
  Heavy timber construction 2304.10
  Hurricane shutters 1609.1.4
  I-joist . . . . 2303.1.
  Inspection 1704.6
  Lateral force-resisting systems 2305
  Light-frame construction, conventional 2308
  Load and resistance factor design 2307
  Moisture content 2303.1.8.2, 2303.2.5
  Nails and staples 2303.6
  Particleboard shear walls 2306.4.3
  Plywood, hardwood 2303.3
  Preservative treated 1403.6, 2303.1.8
  Roof framing (see ROOF CONSTRUCTION, WOOD) 2304.4
  Roof sheathing 2304.7
  Seismic provisions 2305, 2306, 2308.11 - 2308.12.9
  Shear walls 2305.3, 2306.4
  Standards and quality, minimum 2303
  Stress design, allowable 2306
  Structural panels 2303.1.4
  Supporting masonry 2304.12
  Termite, protection against 2304.11
  Testing, structural 1714
  Trusses 2303.4, 2308.10.7
  Veneer . . . . Chapter 14
  Wall framing (see WALLS, WOOD CONSTRUCTION) 2304.3

Docket # 466

THE COMMONWEALTH OF MASSACHUSETTS
William Francis Galvin
Secretary of the Commonwealth

Regulation Filing *To be completed by filing agency*

CHAPTER NUMBER: **780 CMR 13.00**

CHAPTER TITLE: **Energy Conservation**

AGENCY: **State Board of Building Regulations and Standards**

SUMMARY OF REGULATION: *State the general requirements and purposes of this regulation.*

This regulation sets forth requirements for the effective use of energy in structures other than low rise residential buildings.

REGULATORY AUTHORITY: **C.802 of the Acts of 1972, as amended and MGL C. 143 Sections 93-100.**

AGENCY CONTACT: **Rob Anderson** PHONE: **617-727-3200 x-25206**

ADDRESS: **1 Ashburton Place, Boston, MA 02108**

Compliance with M.G.L. c. 30A

EMERGENCY ADOPTION - *if this regulation is adopted as an emergency, state the nature of the emergency.*

PRIOR NOTIFICATION AND/OR APPROVAL - *If prior notification to and/or approval of the Governor, Legislature or others was required, list each notification, and/or approval and date, including notice to the Local Government Advisory Commission.*

Department of Housing and Community Development: April 14, 2008

PUBLIC REVIEW - *M.G.L. c. 30A sections 2 and/or 3 requires notice of the hearing or comment period be filed with the Secretary of the Commonwealth, published in appropriate newspapers, and sent to persons to whom specific notice must be given at least 21 days prior to such hearing or comment period.*

Date of public hearing or comment period: **Public Hearing: May 20, 2008**

FISCAL EFFECT - *Estimate the fiscal effect of the public and private sectors.*

For the first and second year:

For the first five years:

No fiscal effect: **Unknown**

SMALL BUSINESS IMPACT - *State the impact of this regulation on small business. Include a description of reporting, record keeping and other compliance requirements as well as the appropriateness of performance versus design standards and whether this regulation duplicates or conflicts with any other regulation. If the purpose of this regulation is to set rates for the state, this section does not apply.*

Unknown.

CODE OF MASSACHUSETTS REGULATIONS INDEX - *List key subjects that are relevant to this regulation:*
This regulation sets forth requirements for the effective use of energy in structures other than low rise residential buildings.

PROMULGATION - *State the action taken by this regulation and its effect on existing provisions of the Code of Massachusetts Regulations (CMR) or repeal, replace or amend. List by CMR number:*

This chapter of 780 CMR, the State Basic Building Code, 7th Edition, REPLACES provisions in the exisiting 780 CMR State Building Code, 7th Edition.

780 CMR 13.00

ATTESTATION - *The regulation described herein and attached hereto is a true copy of the regulation adopted by this agency.* ATTEST:

SIGNATURE: Rob Andersen DATE: 9/22/08

Publication - *To be completed by the Regulations Division*

MASSACHUSETTS REGISTER NUMBER: 1115 DATE: 10/17/08

EFFECTIVE DATE: 10/17/08

CODE OF MASSACHUSETTS REGULATIONS

Remove these pages:	*Insert these pages:*
1, 2 303 - 352	1, 2 303 - 308

TRUE COPY ATTEST
William Francis Galvin
WILLIAM FRANCIS GALVIN
SECRETARY OF THE COMMONWEALTH
9/22/08 CLERK

TABLE OF CONTENTS

780 CMR 1.00 ADMINISTRATION

Section
101 Scope 11
102 Applicability 12
103 Maintenance 13
104 Validity 13
105 Office of the Inspector of Buildings or Building Commissioner 13
106 Duties and Powers of the Building Official 14
107 Duties and Powers of the State Inspector 16
108 Rules and Regulations 17
109 Approval 18
110 Application for Permit 19
111 Permits 22
112 Demolition of Structures 23
113 Conditions of Permit 24
114 Fees 24
115 Inspection 24
116 Registered Architectural and Professional Engineering Services – Construction Control ... 25
117 Workmanship 26
118 Violations 26
119 Stop Work Order 27
120 Certificate of Occupancy 27
121 Unsafe Structures 28
122 Board of Appeals 30
123 Construction Materials Safety Board 33
124 Fire Prevention – Fire Protection Advisory Committee 33
125 Structural Peer Review Advisory Committee ... 34

780 CMR 2.00 DEFINITIONS

Section
201 General 35
202 Definitions 35

780 CMR 3.00 USE AND OCCUPANCY CLASSIFICATION

Section
301 General 45
302 Classification 45
303 Assembly Group A 49
304 Business Group B 49
305 Educational Group E 50
306 Factory Group F 50
307 High-Hazard Group H 50
308 Institutional Group I 59
309 Mercantile Group M 61
310 Residential Group R 61
311 Storage Group S 62
312 Utility and Miscellaneous Group U 63

780 CMR 4.00 SPECIAL DETAILED REQUIREMENTS BASED ON USE AND OCCUPANCY

Section
401 Scope 65
402 Covered Mall Buildings 65
403 High-Rise Buildings 69
404 Atriums 70
405 Underground Buildings 71
406 Motor-vehicle-related Occupancies 72
407 Group I-2 76
408 Group I-3 77
409 Motion Picture Projection Rooms 80
410 Stages and Platforms 80
411 Special Amusement Buildings 83
412 Aircraft-related Occupancies 83
413 Combustible Storage 85
414 Hazardous Materials 86
415 Groups H-1, H-2, H-3, H-4 and H-5 90
416 Application of Flammable Finishes 102
417 Drying Rooms 103
418 Organic Coatings 103
419 Mobile Units 103
420 Swimming Pools 103
421 Group Residence 103
422 Day Care Centers 105
423 Summer Camps for Children 110
424 Bulk Merchandising Retail Buildings 110
425 Limited Group Residence 115
426 Detoxification Facilities 118
427 Group Dwelling Units 120

780 CMR 5.00 GENERAL BUILDING HEIGHTS AND AREAS

Section
501 General 125
502 Definitions 125
503 General Height and Area Limitations 125
504 Height Modifications 127
505 Mezzanines 127
506 Area Modifications 128
507 Unlimited Area Buildings 129
508 Special Provisions 130

780 CMR 6.00 TYPES OF CONSTRUCTION

Section
601 General 133
602 Construction Classification 133
603 Combustible Material in Type I and II Construction 134

780 CMR 7.00 FIRE-RESISTANCE-RATED CONSTRUCTION

Section
701 General 137
702 Definitions 137
703 Fire-Resistance Ratings and Fire Tests 138
704 Exterior Walls 140
705 Fire Walls 143
706 Fire Barriers 145
707 Shaft Enclosures 146
708 Fire Partitions 149
709 Smoke Barriers 149
710 Smoke Partitions 150
711 Horizontal Assemblies 150
712 Penetrations 151
713 Fire-resistant Joint Systems 153
714 Fire-resistance Rating of Structural Members .. 154
715 Opening Protectives 155
716 Ducts and Air Transfer Openings 159
717 Concealed Spaces 162

TABLE OF CONTENTS - continued

718 Fire-resistance Requirements for Plaster 164
719 Thermal- and Sound-Insulating Materials 164
720 Prescriptive Fire Resistance 165
721 Calculated Fire Resistance 183

780 CMR 8.00 INTERIOR FINISHES

Section

801 General 213
802 Definitions 213
803 Wall and Ceiling Finishes 213
804 Interior Floor Finish 216
805 Decorations and Trim 217

780 CMR 9.00 FIRE PROTECTION AND LIFE SAFETY SYSTEMS

Section

901 General 219
902 Definitions 222
903 Automatic Sprinkler Systems 226
904 Alternative Automatic Fire-extinguishing Systems 231
905 Standpipe Systems 232
906 Portable Fire Extinguishers 235
907 Fire Alarm and Detection Systems 235
908 Emergency Alarm Systems 244
909 Smoke Control Systems 245
910 Smoke and Heat Vents 254
911 Fire Command Center 256
912 Fire Department Connections 256
913 Private Underground Fire Mains and Yard Hydrants 256
914 Fire Pumps 256
915 Carbon Monoxide Protection 257

780 CMR 10.00 MEANS OF EGRESS

Section

1001 Administration 259
1002 Definitions 259
1003 General Means of Egress 261
1004 Occupant Load 262
1005 Egress Width 263
1006 Means of Egress Illumination 263
1007 Accessible Means of Egress 264
1008 Doors, Gates and Turnstiles 266
1009 Stairways and Handrails 271
1010 Ramps 274
1011 Exit Signs 276
1012 Guards 276
1013 Exit Access 277
1014 Exit and Exit Access Doorways 279
1015 Exit Access Travel Distance 280
1016 Corridors 281
1017 Exits 282
1018 Number of Exits and Continuity 282
1019 Vertical Exit Enclosures 283
1020 Exit Passageways 285
1021 Horizontal Exits 285
1022 Exterior Exit Ramps and Stairways 286
1023 Exit Discharge 287
1024 Assembly 288
1025 Emergency Escape and Rescue 293

780 CMR 11.00 ACCESSIBILITY

Section

1101 Jurisdiction 295

780 CMR 12.00 INTERIOR ENVIRONMENT

Section

1201 General 297
1202 Definitions 297
1203 Ventilation 297
1204 Temperature Control 299
1205 Lighting 299
1206 Yards or Courts 299
1207 Sound Transmission 300
1208 Interior Space Dimensions 300
1209 Access to Unoccupied Spaces 300
1210 Surrounding Materials 301

780 CMR 13.00 ENERGY CONSERVATION

Section

1301 Jurisdiction 303

780 CMR 14.00 EXTERIOR WALLS

Section

1401 General 353
1402 Definitions 353
1403 Performance Requirements 353
1404 Materials 354
1405 Installation of Wall Coverings 355
1406 Combustible Materials on the Exterior Side of Exterior Walls 359
1407 Metal Composite Materials (MCM) 360

780 CMR 15.00 ROOF ASSEMBLIES AND ROOF TOP STRUCTURES

Section

1501 General 363
1502 Definitions 363
1503 Weather Protection 363
1504 Performance Requirements 364
1505 Fire Classification 364
1506 Materials 365
1507 Requirements for Roof Coverings 365
1508 Roof Insulation 375
1509 Rooftop Structures 375
1510 Reroofing 376

780 CMR 16.00 STRUCTURAL DESIGN

Section

1601 General 379
1602 Definitions and Notations 379

780 CMR 13.00

ENERGY EFFICIENCY

780 CMR 1301.0 JURISDICTION

1301.1 Energy Efficiency. Energy Efficiency is to be met via compliance with the International Energy Conservation Code (IECC) 2006 with the 2007 Supplement or ASHRAE 90.1-2007.

1301.1.1 Amendments. To meet Massachusetts energy efficiency requirements, the IECC 2006 is amended as follows:

Insert new sections:

101.5.3 Compliance Alternative. Buildings with total floor area not greater than 10,000 square feet may be designed and constructed using the envelope requirements of 780 CMR 61.00.

101.5.4 Heating, Pumping, Process Piping and Refrigeration Systems. Heating, pumping, process piping and refrigeration systems shall be installed by contractors and personnel appropriately licensed in the Commonwealth of Massachusetts (Installing Contractor). Engineered designs and specifications prepared by Registered Professional Engineers shall identify systems requiring compliance with appropriate sections of M.G.L. c. 146 and 528 CMR. Shop drawings and design layout prepared by licensed installing contractors shall note the name(s), license number(s) and license expiration date(s) of the contractor(s) installing the heating, pumping, process piping and refrigeration systems.

101.5.5 Exempt Buildings. Portions of aircraft hangars where aircraft are housed or stored and/or aircraft servicing, repairs or alterations may occur are exempt from the provisions of 780 CMR 13.00.

Add these four Default Door U-Factors to TABLE 102.1.3(2)

Glass	0.92
Air Lock Entry	0.50
Revolving	0.50
Overhead	1.45

Add the following paragraphs to 104.2 Information on Construction Documents.

The construction documents shall contain sufficient information to completely describe the heating, ventilation, and air conditioning (HVAC); lighting; and electric power distribution systems, including operational features and controls. The information required for each system shall include a summary of:

1. A description of the design intent providing a detailed explanation of the ideas, concepts and criteria that are defined by the owner to be important.
2. A description of the basis of design of the systems including all information necessary to prepare a design to accomplish the design intent.
3. A description of the sequence of operation of the systems and their interaction with other systems, including fire prevention and fire protection systems.
4. A description of the systems including the capacities of the equipment or systems.
5. A description of the testing requirements and the criteria for passing to be used for final systems acceptance.
6. A requirement for submittal of operation manuals and maintenance manuals as a condition of final acceptance, and a description of their format and content. The operation manual shall provide all relevant information needed for day-to-day operation and management of each system. The maintenance manual shall describe equipment inventory and support the maintenance program.
7. A requirement for submittal of record drawings and control documents as a condition of final acceptance, per 780 CMR 116.0.

Add the following sections to 104 CONSTRUCTION DOCUMENTS

104.3 Approval. Approval by the building official of the design concepts, testing procedures, and acceptance criteria of Section 104 is not required, but the building official shall reject the construction documents if these sections are incomplete, or if they specify any design elements that violate other requirements of 780 CMR.

104.4 Design. All HVAC, lighting, and electric power distribution systems including sequence of operation, controls and supporting documentation shall be designed and specified by a qualified Registered Professional Engineer except as provided in M.G.L. c. 143, § 54A and any profession or trade as provided in M.G.L. c. 112, § 60L and M.G.L. c. 112, § 81R. The Registered Professional Engineer(s) or other legally recognized professional (M.G.L. c. 112, § 81R) shall be responsible for the review and certification that all submittals and shop drawings conform to the approved HVAC, lighting, and electric power distribution construction documents as submitted for the building permit and approved by the building official, per 780 CMR 116.0.

104.5 Acceptance. In accordance with the provisions of 780 CMR 120.0, a certificate of occupancy shall not issue until the building official or his designees have witnessed a satisfactory test of all HVAC, lighting control, and electric power distribution systems installed in accordance with the construction documents. All systems shall be tested in accordance with the applicable standards of 780 CMR and documents. In addition, the following documents shall be simultaneously submitted to the building official prior to the issuance of a permanent certificate of occupancy.

1. Certification from the Registered Professional, as allowed in 780 CMR 116.2, stating that the HVAC, lighting, and electric power distribution systems have been installed in substantial accord with the approved construction documents.
2. Confirmation by the building owner/ developer or authorized representative that they have received all HVAC, lighting, and electric power distribution system record drawings from the installing contractors and that the Registered Professional Engineer or other legally recognized professional (M.G.L. c. 112, § 81R) has reviewed their reasonable accuracy.
3. Confirmation by the building owner/ developer or authorized representative that they have received all construction documents required in Section 104 including reports, controls documentation, operation manual(s) and maintenance manual(s).

> **Exception.** In lieu of witnessing a satisfactory functional test, the building official or their designees may accept a final performance acceptance test report from a Registered Professional Engineer or other legally recognized professional (M.G.L. c. 112, § 81R). Said report shall certify that the systems have been tested and satisfactorily meet their performance requirements.

104.6 Unsafe Lighting and Ventilation. The building official may require or accept the documentation required in Section 104.5 in enforcing the provisions of 780 CMR 34.00.

104.7 Conditional Acceptance. The requirements of 780 CMR 104.0 shall not preclude the issuance of a temporary certificate of occupancy by the Building Official in accordance with 780 CMR 120.3 as long as it can be demonstrated that compliance can be accomplished with the building occupied.

Change 105.1 Compliance Materials to read:

The Code official shall be permitted to approve specific computer software, worksheets, compliance manuals and other similar materials that meet the intent of **this code**. This includes, but is not limited to RES*check* and COM*check* software with compliance to the IECC 2006 code.

Add these two definitions to CHAPTER 2

CONTINUOUS AIR BARRIER. The combination of interconnected material and assemblies joined and sealed together with flexible joints that provide the air-tightness of the building envelope above and below grade that separate conditioned from unconditioned space, or from space with temperature and/or humidity conditions that differ by more than 50%.

OUTDOOR AIR. Air taken from the outdoors, and therefore not previously circulated through the system.

Add this exception to SECTION 302 DESIGN CONDITIONS

> **Exception.** Buildings or portions of buildings which require different temperatures and humidity, such as, but not limited to, hospitals, laboratories, museums, art galleries, supermarkets, thermally sensitive equipment rooms, archival storage facilities, and facilities for the elderly, may require the use of alternative indoor design conditions. Any such use of alternative indoor design conditions shall be documented by a licensed professional.

Replace 502.2.4 Below-grade Walls with the following:

The minimum thermal resistance of the insulating material installed in, or continuously on, below grade walls of conditioned spaces shall be specified in Table 502.2(1) and shall extend from the top of the wall to the depth of the bottom of the floor slab.

Make the following changes to Table 502.2(1) BUILDING ENVELOPE REQUIREMENTS – OPAQUE ASSEMBLIES

Walls, above Grade; Metal Framed: Add: or R10 ci
Walls, below Grade: Below Grade wall: Replace NR with R-5 ci.
Slab-on-Grade Floors; Unheated Slabs; Replace NR with R-5 for 24 inches below

Add a second paragraph to 502.2.6 Slabs on Grade.

The entire area of the slab on grade shall be insulated with a minimum of R-5 rigid insulation in the following buildings: schools K-12, including daycare; buildings of use groups R-1, R-2, I-1 and I-2, and; college and university buildings of B and A use groups.

Delete entire content of 502.4 Air Leakage and replace with:

502.4 Air Leakage.

502.4.1 Air Barriers. The building envelope shall be designed and constructed with a continuous air barrier to control air leakage into, or out of the conditioned space and shall also be provided for interior partitions between conditioned space and space designed to maintain temperature or humidity levels which differ from those in the conditioned space by more than 50% of the difference between the conditioned space and design ambient conditions. The continuous air barrier shall have the following characteristics:

1. Materials used in the continuous air barrier shall have an air permeance not to exceed 0.004 cfm/ft^2 under a pressure differential of 0.3 in. water (1.57 psf) when tested in accordance with ASTM E 2178. Air barrier materials shall be taped or sealed in accordance with the manufacturer's instructions.
2. It shall be capable of withstanding positive and negative combined design wind, fan and stack pressures on the envelope without damage or displacement, and shall transfer the load to the structure. It shall not displace adjacent materials under full load.
3. Air barrier materials shall be maintainable, or, if inaccessible, shall meet durability requirements for the service life of the envelope assembly.
4. The air barrier material of an envelope assembly shall be joined and sealed in a flexible manner to the air barrier material of adjacent assemblies, allowing for the relative movement of assemblies due to thermal and moisture variations and creep. Connection shall be made between:
   - a. Foundation and walls.
   - b. Walls and windows or doors.
   - c. Different wall systems.
   - d. Wall and roof.
   - e. Wall and roof over unconditioned space.
   - f. Walls, floor and roof across construction, control and expansion joints.
   - g. Walls, floors and roof to utility, pipe and duct penetrations.

502.4.2 Air Barrier Penetrations. All penetrations of the air barrier and paths of air infiltration/exfiltration shall be made air tight.

502.4.3 Fenestration and Doors. Air leakage for fenestration and doors shall be determined in accordance with NFRC 400 or ASTM E 283 @ 1.57 psf (75 Pa.). Air leakage shall be determined by an independent laboratory accredited by a nationally recognized accreditation organization and shall be certified by the manufacturer. Air leakage shall not exceed 0.5 cfm/ft^2 for glazed swinging entrance doors and for revolving doors, and 0.3 cfm/ft^2 for all other products under a pressure differential of 0.3 inches of water (1.57 psf).

Exceptions:

1. Field fabricated fenestration and doors that are weather-stripped.
2. For garage doors, air leakage determined by test at standard test conditions in accordance with ANSI/DASMA 105 shall be an acceptable alternate for compliance with air leakage requirements.

502.4.4 Doors and Access Openings to Shafts, Chutes, Stairwells, and Elevator Lobbies: These doors and access openings shall either meet the requirements of 780 CMR 502.4.3 or shall be equipped with weatherseals.

Exception. Weatherseals on elevator lobby doors are not required when a smoke control system is installed in accordance with 780 CMR 909.0

502.4.5 Loading Dock Weatherseals. Cargo doors and loading dock doors shall be equipped with weatherseals to restrict infiltration when vehicles are parked in the doorway.

502.4.6 Vestibules. A door that separates conditioned space from the exterior shall be protected with an enclosed vestibule, with all doors opening into and out of the vestibule equipped with self closing devices. Vestibules shall be designed so that in passing through the vestibule it is not necessary for the interior and exterior doors to open at the same time. Interior and exterior doors shall have a minimum distance between them of not less than seven ft (2.1 m) when in the closed position.

Exceptions:

1. doors not intended to be used as a building entrance door, such as doors for mechanical or electrical equipment rooms;
2. doors opening directly from a dwelling unit;
3. doors that open directly from a space less than 3000 ft^2 (200 m^2) in area
4. revolving doors or doors adjacent to revolving doors;
5. doors used primarily to facilitate vehicular movement or material handling and adjacent personnel doors.

502.4.7 Air-tight Dampers. Air-tight operable dampers shall be installed where the air barrier is penetrated by:

1. fixed open louvers such as in elevator shafts and machine rooms;
2. mechanical system components which allow infiltration or exfiltration of air when the systems are inactive, such as atrium smoke exhaust systems and make up air louvers;
3. outside air intakes, exhaust outlets, relief outlets, stair shaft, elevator shaft smoke relief openings, and other similar elements.

Such dampers shall have a leakage no greater than 3cfm/ft^2 at 1.0 in w.g. when tested in accordance with AMCA Standard 500. They shall be set in the closed position, and shall automatically open upon:

1. the activation of any fire alarm initiating device of the building's fire alarm system;
2. the interruption of power to the damper.

502.4.8 Recessed Lighting Fixtures. When installed in the building envelope, recessed lighting fixtures shall meet one of the following requirements:

1. Type IC rated, manufactured with no penetrations between the inside of the recessed fixture and ceiling cavity and sealed or gasketed to prevent air leakage into the unconditioned space.
2. Type IC rated, in accordance with ASTM E 283 no more than 2.0 cfm air movement from the conditioned space to the ceiling cavity. The lighting fixture shall be tested at 75 Pa or 1.57 lbs./ft.^{2} pressure difference and shall be labeled.

502.4.9 Envelope Gaps and Cavities.: All gaps and cavities between rough framing and door and window heads, jambs, and sills shall be filled with insulation and the window and door frames sealed to the air barrier of adjacent assemblies.

Add these exceptions to 502.5 Moisture Control.

4. Materials to the exterior of a ventilated rainscreen cavity may have any permeability.
5. Envelope systems that maintain the temperature of potential condensing surfaces (typically the interface of exterior sheathing with cavity insulation) above the dewpoint temperature of the interior air.
6. Envelope systems that maintain the moisture content of all building materials that comprise the assembly to the interior of the water-resistive barrier below the equilibrium moisture content the materials would achieve when exposed to relative humidity of 80%.
7. Buildings with unusual interior design conditions (such as continually refrigerated buildings, ice rinks, cold storage) shall demonstrate compliance by the method in Exception 6.

Insert new section 505.8 TRANSFORMERS

505.8 Transformers. Standards for liquid-immersed and medium-voltage, dry type distribution transformers will be superseded by federal rules effective January 1, 2010. See 10 CFR 431 - "Energy Conservation Program for Commercial Equipment: Distribution Transformers Energy Conservation Standards: Final Rule"

505.8.1 Liquid Immersed Transformers. Liquid immersed transformers shall comply with the minimum efficiencies in Table 505.8.1 as tested and rated in accordance with Section 313 of the Electric Utility Industry Restructuring Act of November 25, 1997 ("NEMA TP1.")

505.8.2 Low Voltage Dry-Type Transformers: Low Voltage Dry-type transformers shall comply with the minimum efficiencies in Table 505.8.2 as tested and rated in accordance with NEMA TP 1.

505.8.3 Medium Voltage Dry-Type Transformers: Medium Voltage Dry-type transformers shall have efficiencies not less than the applicable values in Table 505.8.3 when tested at 50% of the rated output power and at 75°C (Table 505.8.3 copies Table 4-2 of NEMA TP 1-2002, but adds 3/10 point for each value per M.G.L. c. 25B).

TABLE 505.8.1 NEMA CLASS 1 EFFICIENCY LEVELS FOR LIQUID-FILLED DISTRIBUTION TRANSFORMERS

Reference Condition	Temperature	% of Nameplate Load
Load Loss	85°C	50%
No Load Loss	20°C	50%

kVA	Single Phase Efficiency	kVA	Three Phase Efficiency
10	98.3	15	98.0
15	98.5	30	98.3
25	98.7	45	98.5
37.5	98.8	75	98.7
50	98.9	112.5	98.8
75	99.0	150	98.9
100	99.0	225	99.0
167	99.1	300	99.0
250	99.2	500	99.1
333	99.2	750	99.2
500	99.3	1000	99.2
667	99.4	1500	99.3
883	99.4	2000	99.4
		2500	99.4

TABLE 505.8.2 NEMA CLASS 1 EFFICIENCY LEVELS FOR LOW VOLTAGE DRY-TYPE DISTRIBUTION TRANSFORMERS

Reference Condition Low Voltage		Temperature 75° C	% of Nameplate Load 35%
Single Phase Efficiency		Three Phase Efficiency	
kVa	Low Voltage	kVa	Low Voltage
15	97.7	15	97.0
25	98.0	30	97.5
37.5	98.2	45	97.7
50	98.3	75	98.0
75	98.5	112.5	98.2
100	98.6	150	98.3
167	98.7	225	98.5
250	98.8	300	98.6
333	98.9	500	98.7
500	--	750	98.8
667	--	1000	98.9
833	--	1500	--
		2000	--
		2500	--

TABLE 505.8.3 NEMA CLASS 1 EFFICIENCY LEVELS FOR MEDIUM VOLTAGE DRY-TYPE DISTRIBUTION TRANSFORMERS

Reference Condition Medium Voltage		Temperature 75°C		% of Nameplate Load 50%	
Single Phase			Three Phase		
Rated power output in kVa	Minimum efficiency %		Rated power output in kVa	Minimum efficiency %	
	≤ 60kV BIL	> 60kV BIL		≤ 60kV BIL	> 60kV BIL
≥15 <25	97.9	97.9	≥15 <30	97.1	97.1
≥25 <37.5	98.2	98.2	≥30 <45	97.6	97.6
≥37.5 <50	98.4	98.4	≥45 <75	97.9	97.9
≥50 <75	98.5	98.5	≥75 <112.5	98.2	98.2
≥75 <100	98.7	98.7	≥112.5 <150	98.4	98.4
≥100 <167	98.8	98.8	≥150 <225	98.5	98.5
≥167 <250	99.1	99	≥225 <300	98.7	98.7
≥250 <333	99.2	99.1	≥300 <500	99.1	98.8
≥333 <500	99.3	99.2	≥500 <750	99.1	99
≥500 <667	99.4	99.3	≥750 <1000	99.2	99.1
≥667 <833	99.5	99.3	≥1000 <1500	99.3	99.2
833	99.5	99.4	≥1500 <2000	99.4	99.3
			≥2000 <2500	99.5	99.3
			2500	99.5	99.4

kVa = kilovolt amperes
kV = kilovolts
BIL = basic impulse insulation level

***Insert or edit these references in Chapter 6 REFERENCED STANDARDS*:**

***Add to ANSI*:**

105 -1992 (R2004)	ANSI/DASMA Test Method for Thermal Transmittance and Air Infiltration of Garage Doors 13

Change the year from 2004 to 2007 on this ASHRAE standard

90.1-2007	Energy Standard for Buildiongs Except Low-rise Residential Buildings (ANSI/ASRAE/IESNA 90.1-2007)

Add to ASTM

E 2178-03	Standard Test Method for Air Permeance of Building Materials 13

PAGES 309 THROUGH 352 ARE RESERVED FOR FUTURE USE.

3823 14

DATE DUE

NOV 11 '02	MAR 07 2005	NOV 15 '09	[illegible] 7 '14
NOV 21 '02	FEB 28 2006	NOV 15 '09 NOV 16 '09	APR 8 '14
NOV 22 '02	MAR 19 2006	NOV 17 '09	APR 9 '14
NOV 23 '02	MAR 20 2006	NOV 18 '09	JUL 11 '19
MAR 21 '03	FEB 05 2007	DEC 21 '09	JUL 12 '19
MAR 08 '03	MAR 01 2007	DEC 23 '09	JUL 15 '19
MAR 09 '03	MAR 24 2007	APR 23 '10	JUL 30 '19
MAR 10 '03	MAR 18 2007	OCT 19 '10	APR 8 '20
MAR 11 '03	SEP 26 '07	OCT 20 '10	APR [illegible]
APR 09 '03	SEP 28 '07	Oct6	OCT 19 [illegible]
APR 10 '03	DEC 4 '07	NOV 21 '10	FEB 21 [illegible]
OCT 06 '03	MAR 25 '08	MAY 23 '12	FEB 22 '23
NOV 10 '03	APR 26 '08	SEP 10 '13	MAY 4 [illegible]
DEC 14 '03	OCT 3 '09	APR 6 '14	MAY 8 '23

DATE DUE

EB 28 '04	APR 2 6 2006	DEC 20 '08	JUL 3 '13
MAR 4 '04	MAY 1 3 2006	FEB 24 '09	JUL [illegible] '13
MAR 26 '04	SEP 2 5 2006	APR 9 '09	9/11/13
	NOV 0 7 2006	OCT 18 '09	OCT 29 '18
MAY 11 '04	APR 2 4 2007	OCT 21 '09	DEC 6 '18
MAY 12 '04	NOV 27 '07	[illegible] 7 '10	JUL 10 '19
NOV 1 0 2004	FEB 29 '08	MAY 22 '10	SEP 16 '19
NOV 1 1 2004	[illegible]	OCT 17 '10	OCT 17 '19
MAY 1 5 2005	FEB 16 '08	MAY 19 '12	OCT 19 '19
MAY 1 6 2005	APR 23 '08	OCT 10 '12	OCT 20 '19
MAY 1 7 2005	APR 24 '08	OCT 29 '12	MAR 7 '20
OCT 1 3 2005	APR 25 '08	NOV 30 '12	MAR 8 '20
OCT 2 9 2005	OCT 3 '08	DEC 15 '12	APR 4 '23
	DEC 7 '08	MAR 8 '13	MAY 5 '23

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